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ELECTRONIC DIAGNOSTICS

A compilation of ENGINE MANAGEMENT GUIDES from *Car Mechanics* magazine

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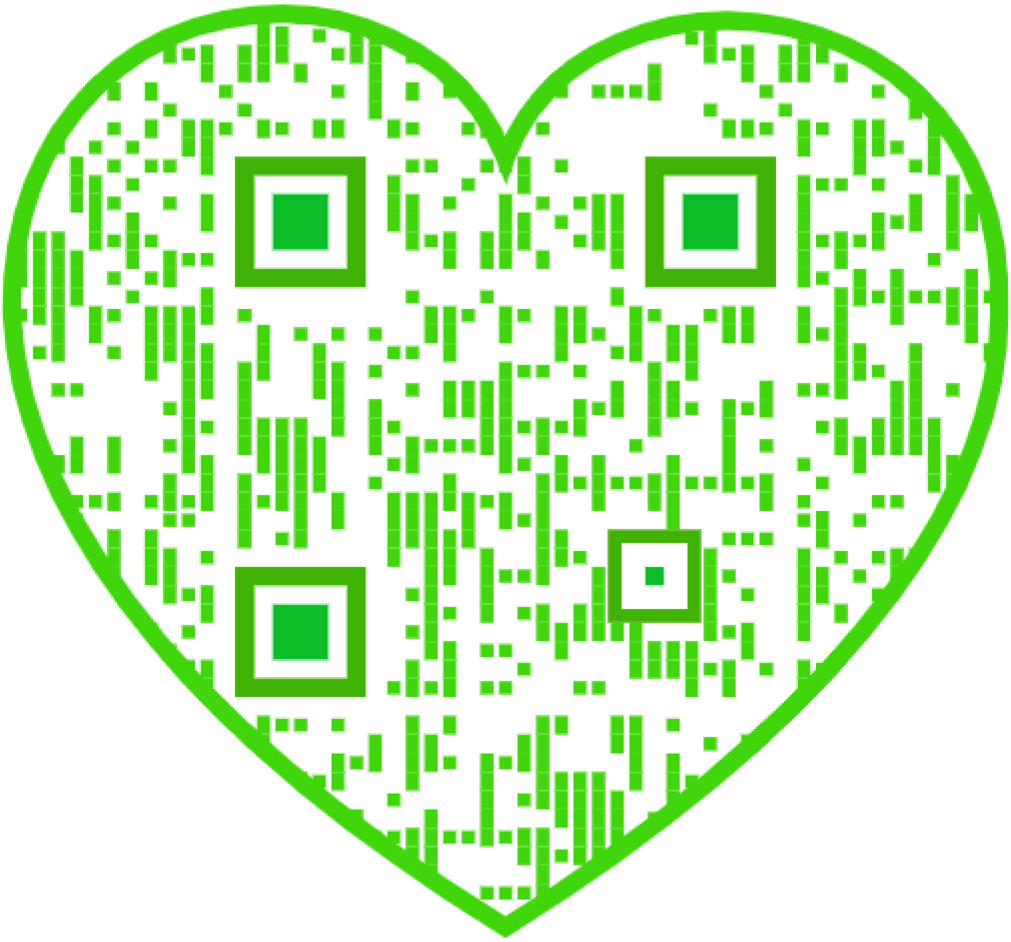
RPM(rpm) 1031
VSS(km/h) 0
SPARKADV(°) 21.0
IAT(°C) 9
TP(%) 9.8
O2SLOC B1S12--B2S--
OBDII/EOBD
READ
ERASE
I/M
BACK
HELP
ENTER



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From the editor

▶ This 100-page book is the fourth in a line of volumes under the electronic diagnostics subject. **Volume 1** in this series published in 2022, **Volume 2** in 2023 and **Volume 3** in 2024 – visit **https://shop.kelsey.co.uk/car-mechanics-expert-magazine** to place an order. *Electronic Diagnostics* **Volume 5** will appear in March 2026.

The vehicles shown in this book are a compilation of articles printed in *Car Mechanics* magazine from 2019 to 2020.

The aim of these features is to provide easy-to-follow guides to tracing common faults in modern electronic engine management systems. Seventeen makes and models are covered in this volume.

Kim Henson is our author of all the *Electronic Diagnostics* features you will read in this book, helped by Edward Haggar with his expert inside knowledge on all things concerning automotive electrics. We'd like to thank them both for their hard work in producing these features.

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Martyn Knowles

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Electronic Diagnostics

LAND ROVER FREELANDER 2.0 Td4

Tracing and fixing faults in electronic engine management systems

The Freelanders powered by BMW diesel engines are popular machines, but what about their diagnostic aspects? **Kim Henson** and **Edward Haggar** delve under the bonnet of a 2004 example.

NOTE: All references in our text and captions to 'left' and 'right' sides are from the point of view of someone sitting in the car and looking ahead.

Introduced for 1998, the first-generation, four-wheel drive Freelander proved to be a popular vehicle, dynamically capable both on- and off-road. Early engine choices included 1.8-litre Rover K-Series petrol units and 2.0-litre Rover L-Series diesels. However, from 2001, a 2.5-litre Rover KV6 petrol unit was offered for those seeking more power. At the same time, buyers of diesels had a 2.0-litre BMW M47 engine (Td4 model designation) under the bonnet. The range received a facelift in 2004, before being replaced by an all-new second-generation line-up two years later.

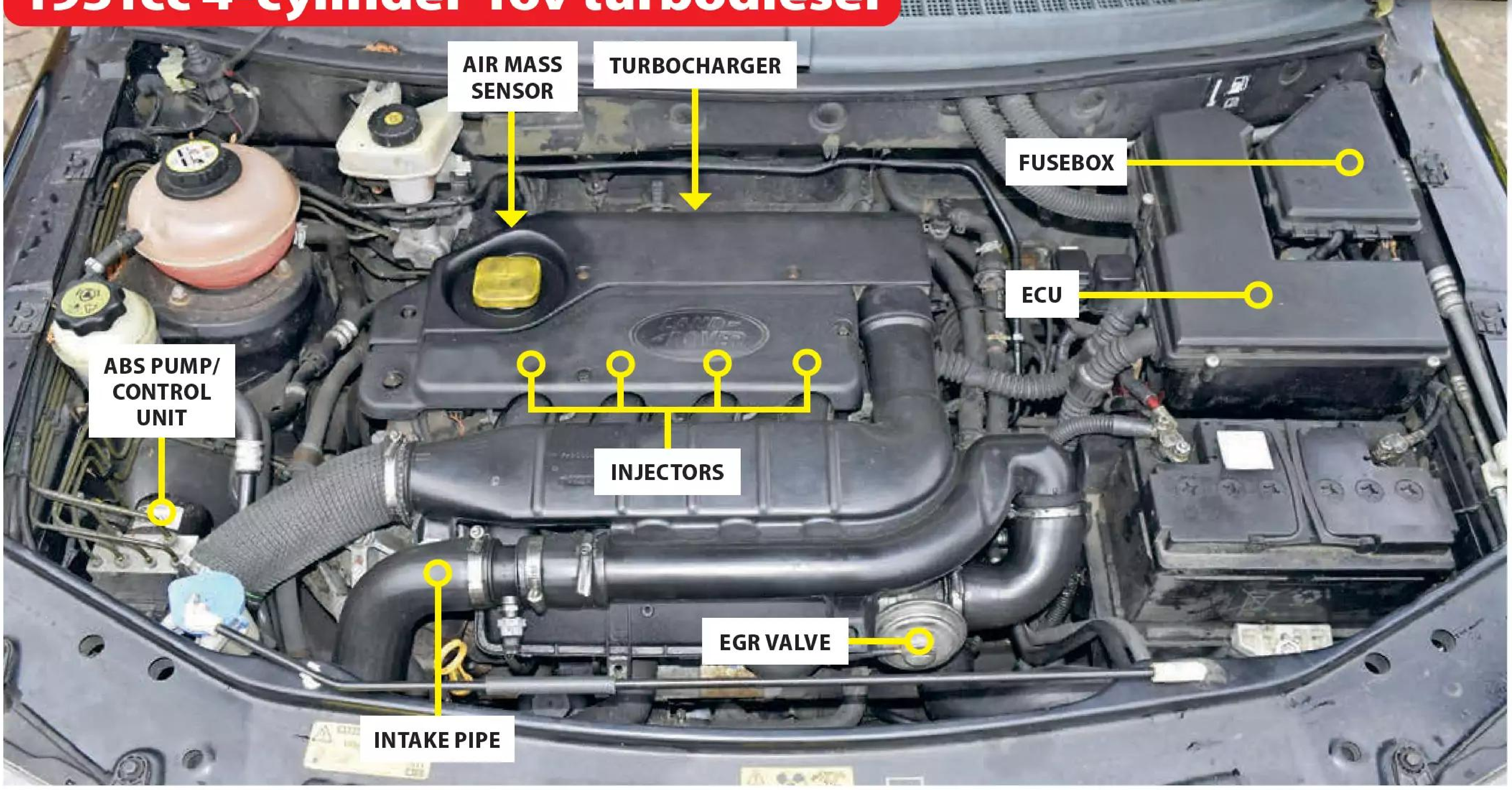
The vehicle in our photographs is a tidy Td4 example, first registered in May 2004. Its engine, produced from 1998 until 2007, was used in many BMW and Rover models of the same era. These units are known to be very reliable and inexpensive to maintain.

It is worth noting that the Freelander received bad press over reliability issues but, in most cases – and particularly with the Td4 – this was down to niggling minor faults rather than serious problems. Compared with more recent Land Rovers, which are stuffed with sometimes temperamental technology, they are very reliable overall. And with so many examples on the road, parts are widely available and usually reasonably priced.

TYPICAL FAULTS

1. EXTENDED ENGINE CRANKING IN EARLY STAGES, THEN POSSIBLE COMPLETE FAILURE TO START
2. POWER LOSS
3. BLUE SMOKE FROM THE EXHAUST, WITH INCREASED OIL CONSUMPTION
4. NON-STARTING, ACCOMPANIED BY A SMELL OF FUEL
5. HILL DESCENT/ABS/TRACTION CONTROL WARNING LAMP ILLUMINATED

1951cc 4-cylinder 16v turbodiesel



ENGINE MANAGEMENT

The Bosch CP1 management system used on this Freelander incorporates these primary components:

- Four high-pressure solenoid injectors.
- High-pressure fuel pump driven via timing chain.
- Crankshaft and camshaft sensors providing engine speed information.
- Air mass sensor mounted in air filter housing.
- Pedal-mounted throttle position sensor.
- Fuel pump located with fuel filter housing under right-hand rear of vehicle.
- Fuel pump relay and fuse within the underbonnet fusebox.
- Solenoid-operated EGR valve.
- Fuel rail pressure sensor mounted on end of rail.
- Coolant temperature sensor located in coolant housing.
- Cooling fans operated by their own control relay unit.

Preparation

The BMW M47 engine used in this Freelander Td4 is a dependable unit and, in most respects, not costly to maintain. Servicing requirements are straightforward and can easily be performed at home. Whereas the Rover-sourced L-Series engine used in previous diesel-powered Freelanders had a cambelt, the BMW motor employs a timing chain.

It is worth noting that some components are difficult to access. These include the high-pressure diesel fuel pump and the crankshaft sensor, both located low down in the engine at the front of the cylinder block. Removing the pump is a time-consuming operation involving detaching the inlet manifold and many other parts, so it is wise to renew the crankshaft sensor at the same time, even if it hasn't failed. It is also useful to note that the pump needs to provide very high fuel pressure for the engine to start, with the pressure dropping once the engine is idling.

Tool of choice

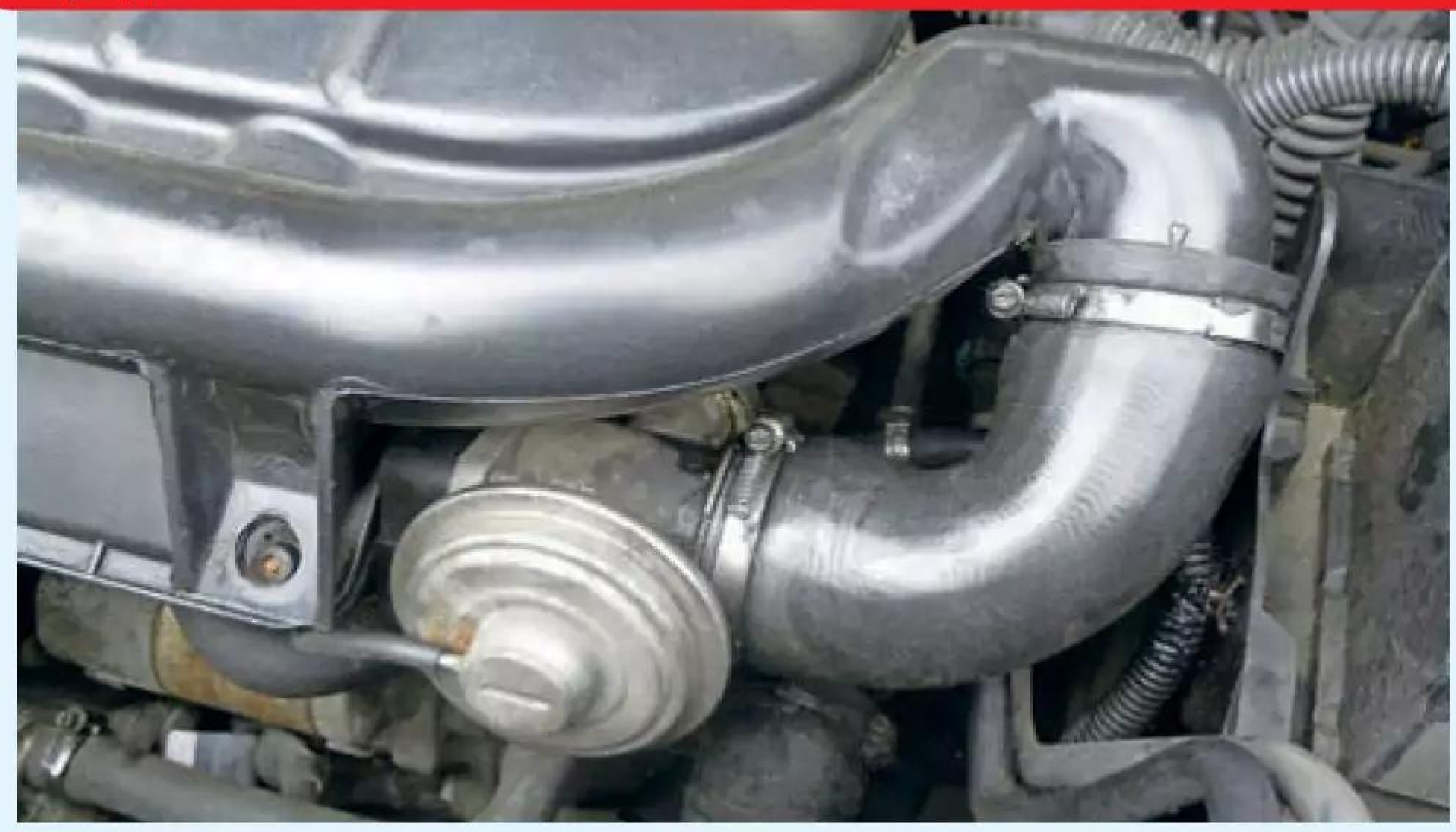
- The **Snap-on SOLUS Edge** diagnostic tool is very useful for this Land Rover and can also be used for a variety of other makes and models.

Fault 1:

WORN FUEL INJECTORS

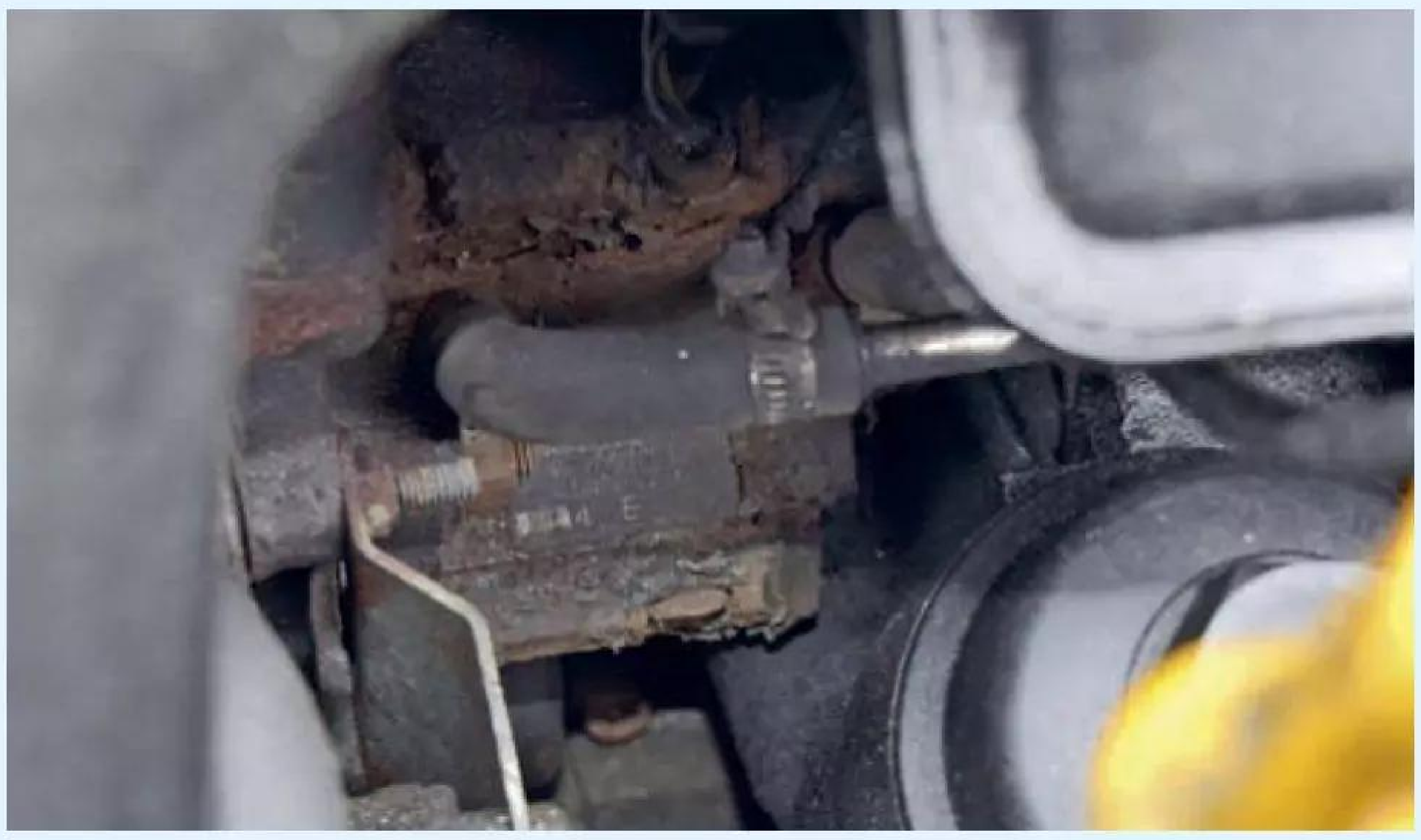
In the early stages, the driver will find that the engine takes a long time to crank/start, but eventually the engine will fail to start at all. The problem is down to a worn fuel injector or injectors. A simple leak-off kit is all that's needed to diagnose the fault. The offending cylinders will be readily identifiable by

Typical Land Rover Freelander components

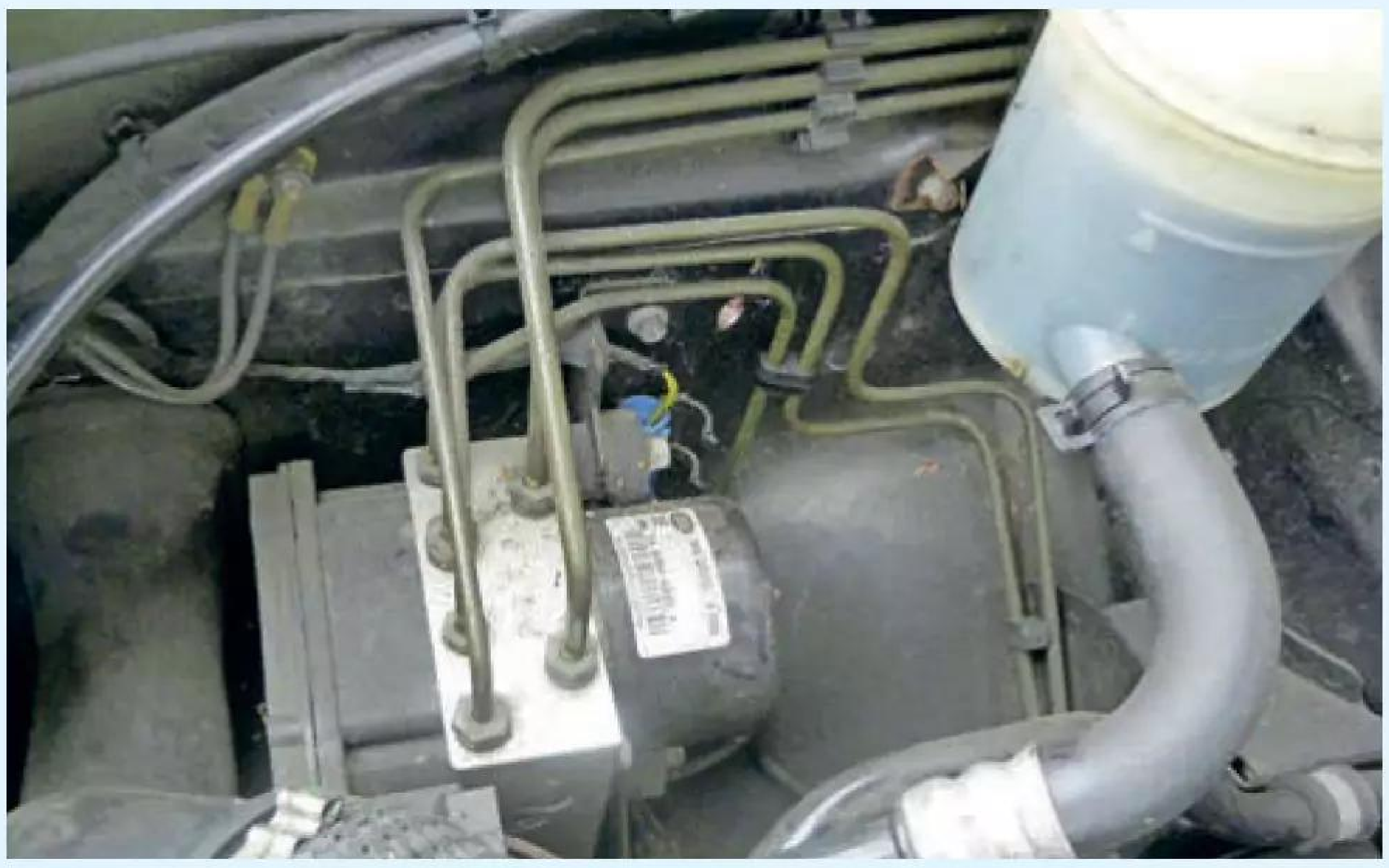


1 **The intercooler hose can be found towards the front of the engine compartment, on the left-hand side. As it's fragile, its condition needs to be checked. The nearby throttle body assembly must be kept clean internally.**

2 **With the engine idling, look for smoke, oil deposits from the dipstick tube, when the dipstick is withdrawn – it's an indication that the engine breather system is obstructed. This also applies to other vehicles with the BMW M47 engine.**



3 **The difficult-to-access high-pressure fuel pump – just visible in the centre of this shot – is mounted very low down at the front of the engine bay, towards the right-hand side. If the pump fails, the engine may crank but not start and the pump may be leaking diesel.**



4 **The pump assembly with an integral ECU serving the anti-lock brake (ABS) system is positioned in the front right-hand corner of the engine bay, just behind the headlamp.**

USEFUL DATA

These are the official change intervals for the various components. However, we recommend that the service/change intervals are at least halved.

Service interval Every 12,000 miles or 12 months, whichever comes first

Air filter Every 24,000 miles or two years, whichever comes first

Engine oil & filter Every 12,000 miles or 12 months, whichever comes first

Oil type 5W-30 fully-synthetic. It's essential that only the correct specification oil is used

Capacity (service fill) 6.9 litres

Sump plug torque figure 28Nm

Oil filter torque figure 25Nm

Brake fluid Every two years

excessive fuel leakage.

To renew the injectors, it is simply a matter of releasing the retaining clamp and lifting out the injector. If the injector should prove reluctant to move, the careful use of a slide hammer will help.

If you have access to a diagnostic tool, it is worth looking at live data, specifically cylinder balance, to highlight any deviations.

When fitting the new injector, always replace the copper washer and ensure that the aperture is free from soot and dirt.

The injectors are coded, but will operate without coding. Nevertheless, we recommend that coding is carried out to ensure the correct fuel delivery balance.

Fault 2:

AILING AIR MASS SENSOR

If the air mass sensor starts to fail, the vehicle will be down on power and the performance will feel flat. It may also seem as if the turbocharger isn't operating.

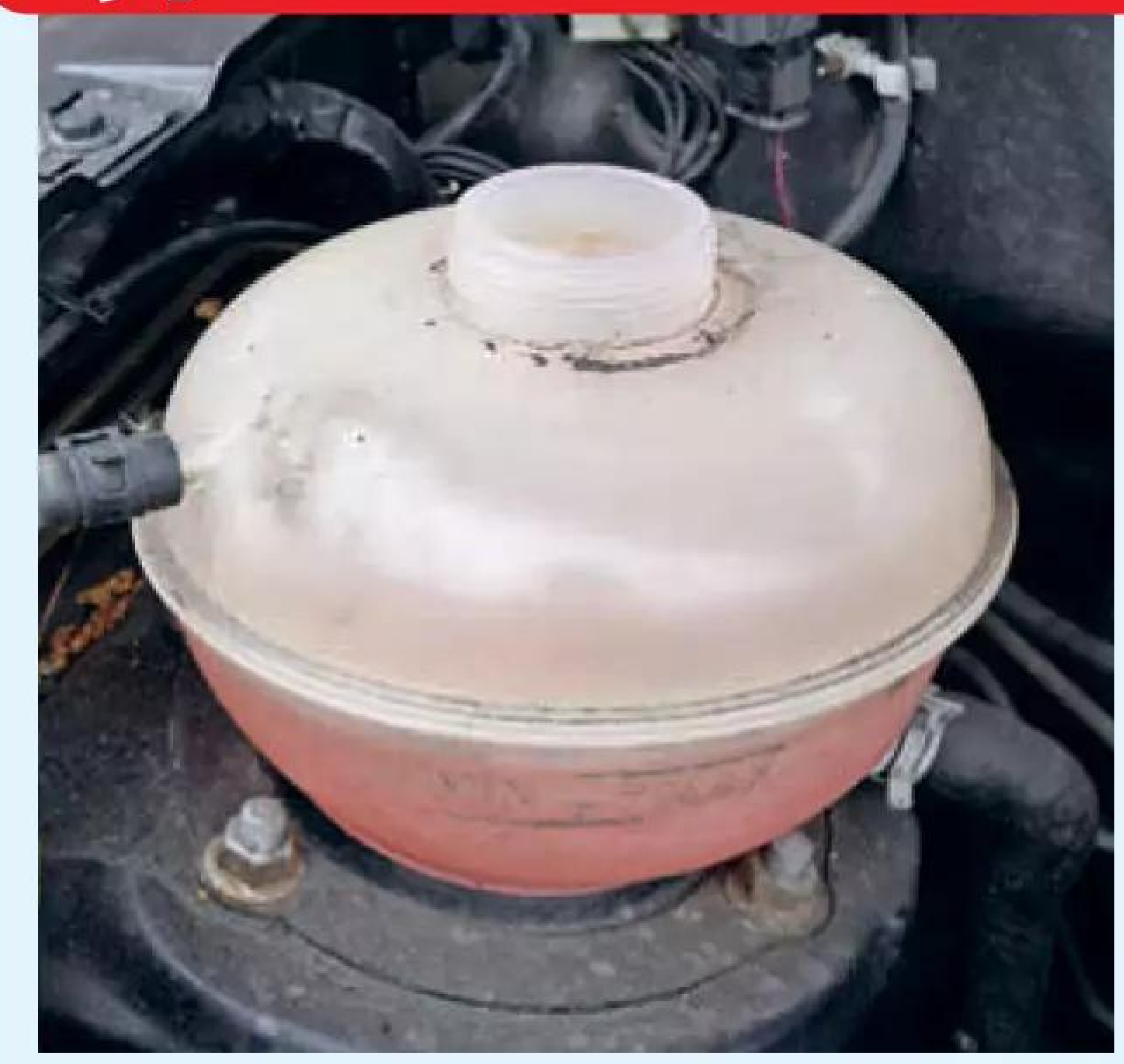
The first step is to carry out diagnostic interrogation to establish if any fault codes are stored, looking for a code relating to the air mass sensor. However, be aware that the ECU may still see the sensor operating within design tolerances, in which case it won't flag a fault code.

An oscilloscope is the tool of choice to get an accurate state of the sensor. It's helpful to have a live data shot of a sensor in good condition for reference/comparative purposes.

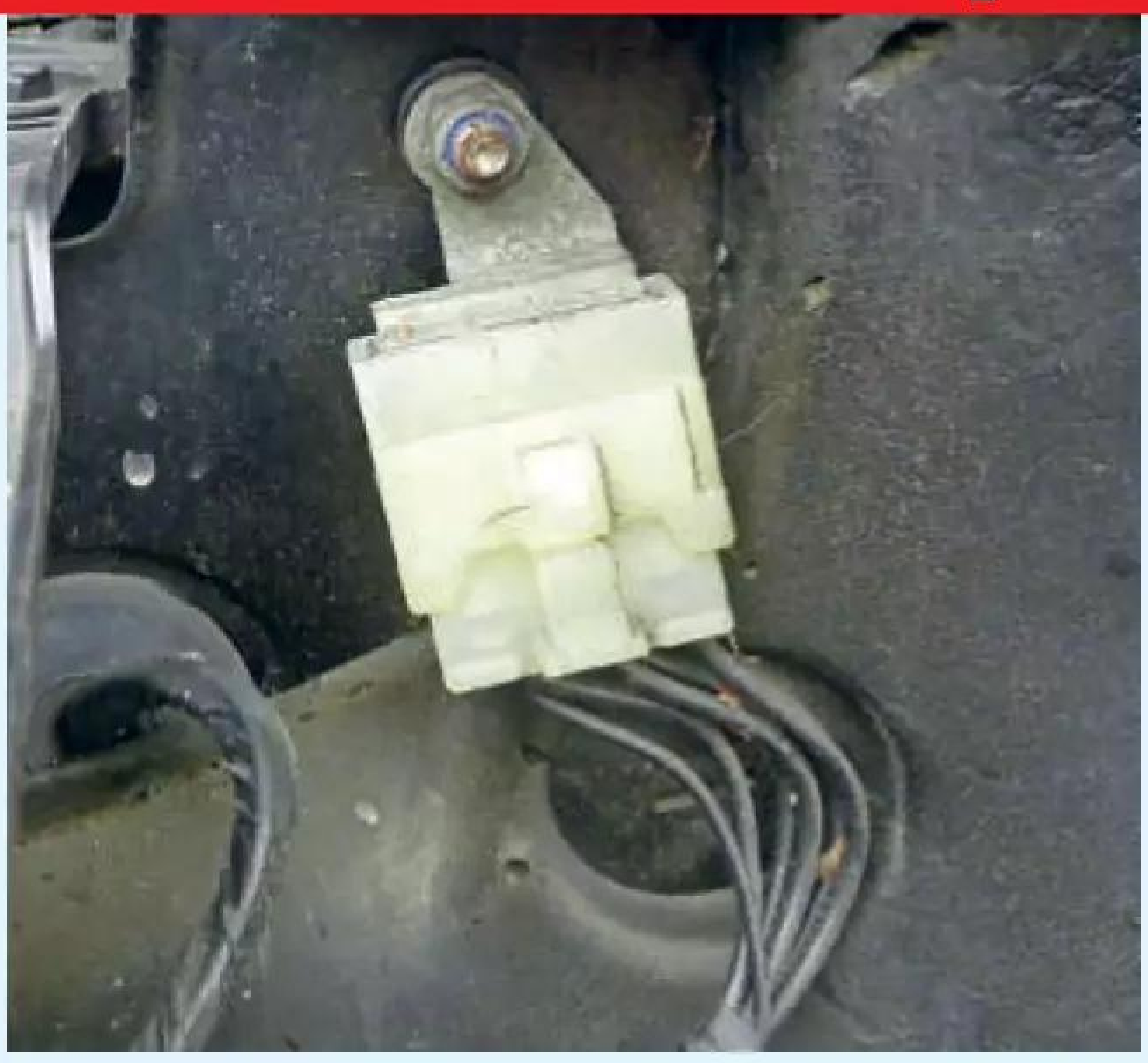
Another quick test is to disconnect the sensor and road-test the vehicle. As the ECU cannot detect the sensor, the ECU operates in a fall-back position which will gives the vehicle more power.

To access the sensor, simply remove the top cover. The air filter can also be found beneath the engine's top cover, secured with Allen screws, and it's worth examining the state of the filter at the same time and renewing it if necessary.

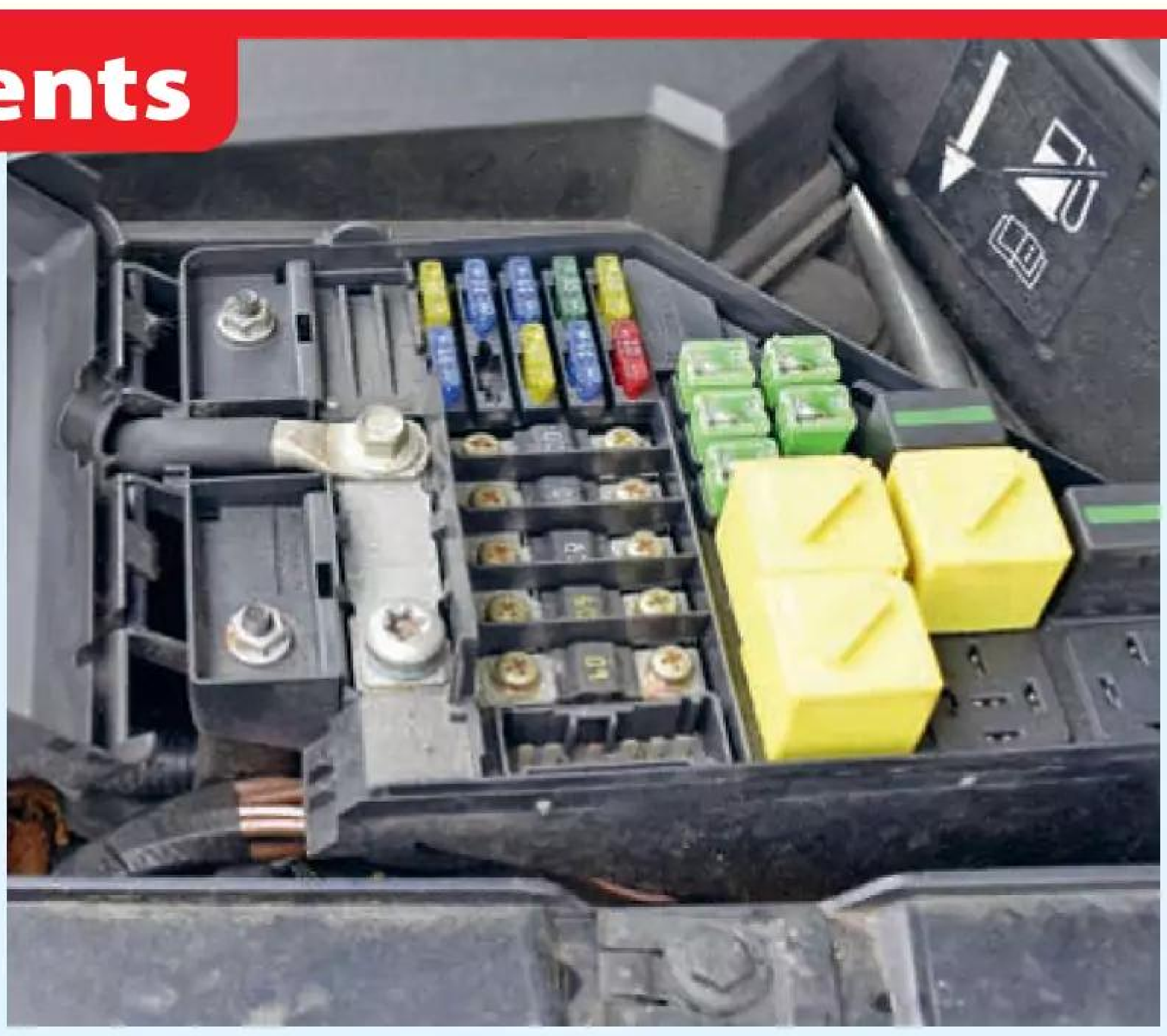
Typical Land Rover Freelander components



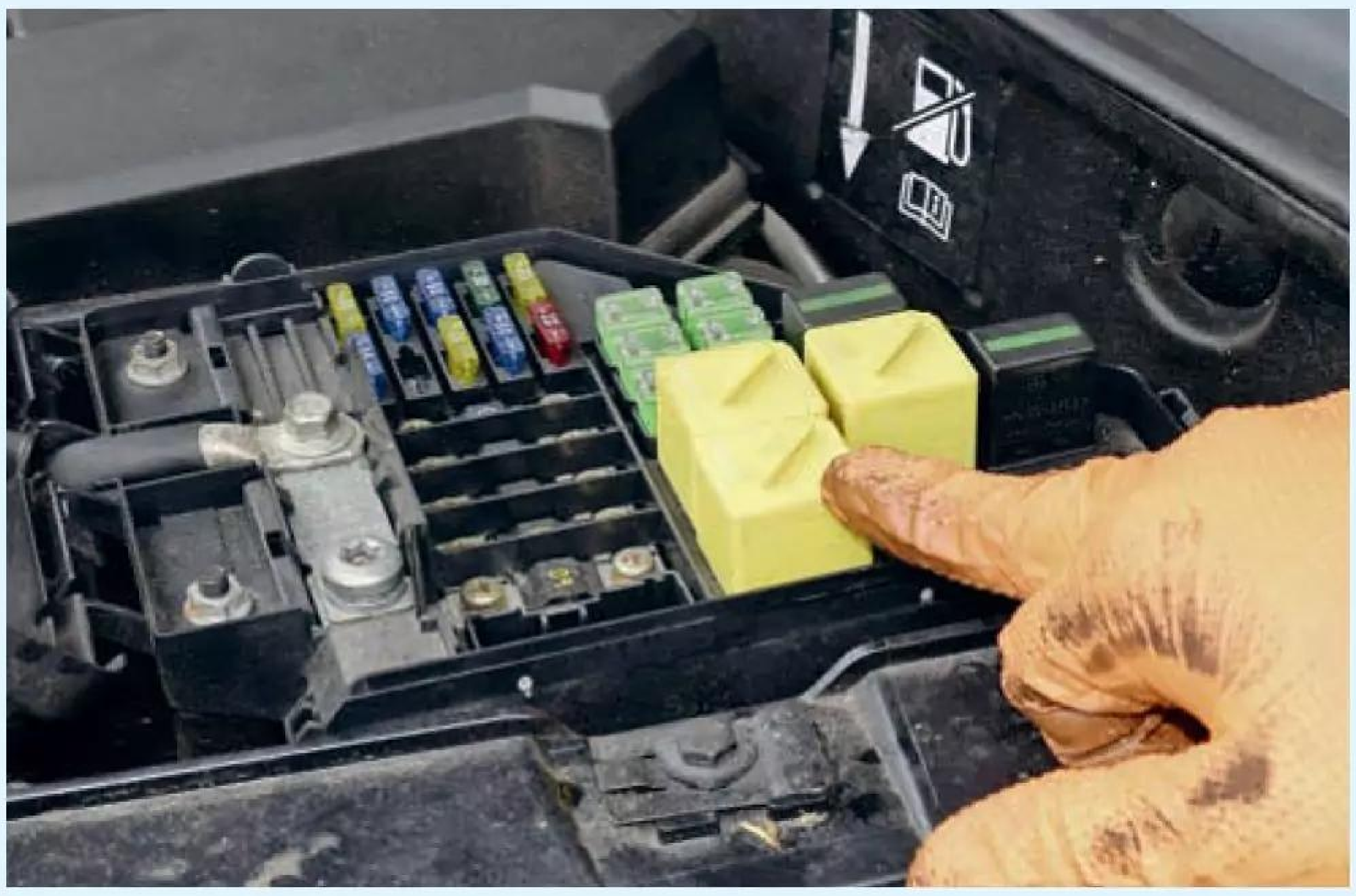
5 **The coolant expansion tank is mounted in the right-hand rear corner of the engine bay, close to the bulkhead. Carefully examine the tank for cracks, usually occuring close to the top of the tank.**



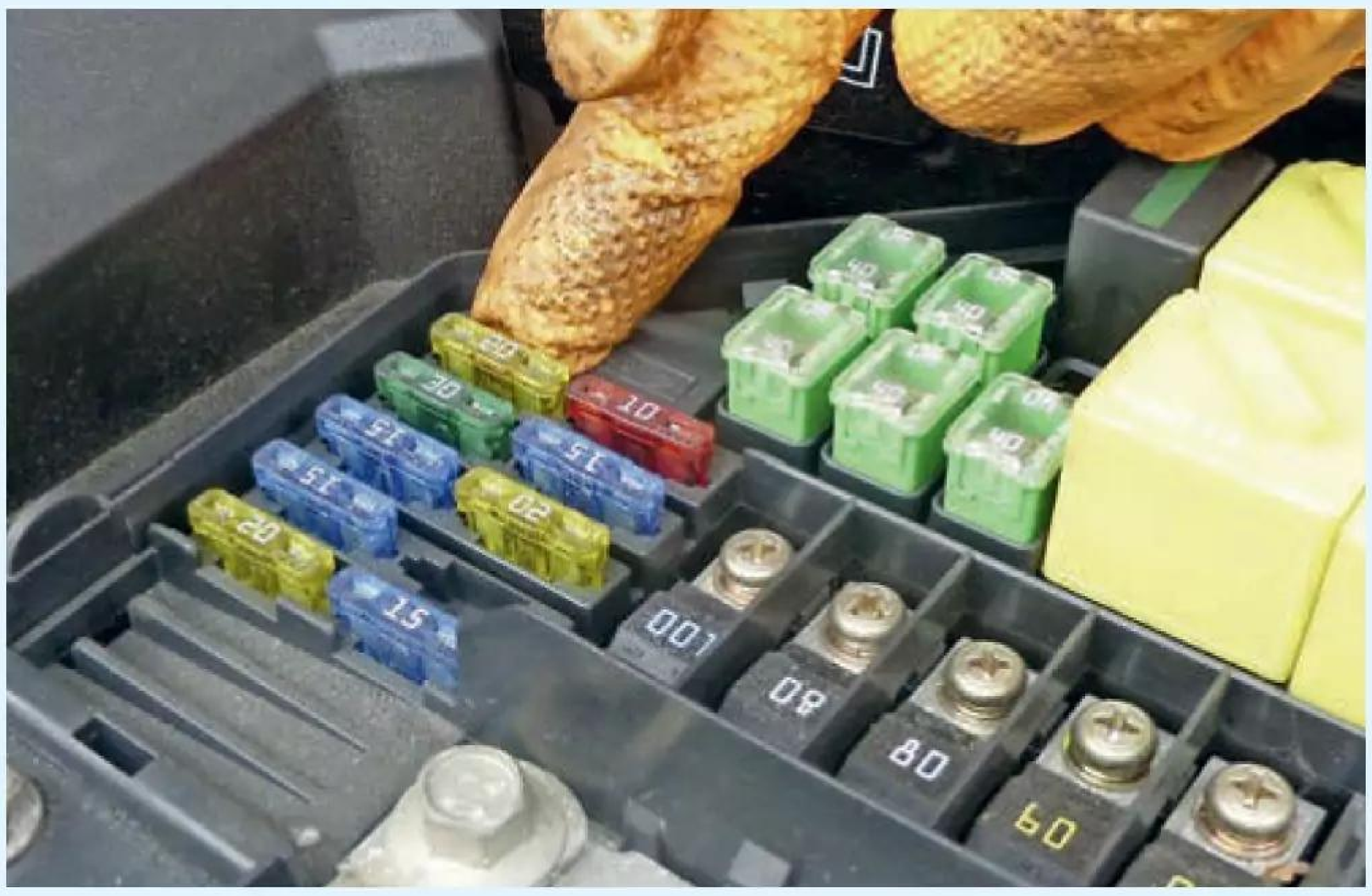
6 **There's a vital multiple-connection earth point on the far right-hand side of the underbonnet bulkhead. Ensure that all the cables and connections here are clean and sound. If in doubt, carefully dismantle, clean and reassemble everything.**



7 **The underbonnet fuse and relay box is found on the left-hand side of the engine bay. Ensure that the lid (which has labelled locations for the fuses and relays) is intact and fits snuggly all around its perimeter, to stop moisture from reaching the electrics.**



8 **Here, we are highlighting the vital relay for the fuel pump. This is a conventional relay, so it could be swapped to rule out a non-start fuel pump issue.**



9 **This 20-amp fuse serves the fuel pump. An amp clamp could be used here to test the current draw of the pump, with a high amp draw possibly indicating a worn fuel pump or wiring problem.**

Fault 3:

BLOCKED CRANKCASE BREATHER

If the engine is emitting blue smoke from the exhaust, accompanied by an increase in oil consumption, it's likely the crankcase breather is obstructed. A quick test is to gently lift the dipstick when the engine is running, to see if oil is pumped out. However, be aware that this can result in a lot of oil being ejected from the engine, so take care.

Fault 4:

LEAKING HIGH-PRESSURE FUEL PUMP

Technical Specs

Actual values

Component	Value
Glow plugs	0.5-2.5 ohms
Injectors	0.5-0.8 ohms
Crank sensor	605 ohms
EGR solenoid	16 ohms
Fuel feed/lift pump pressure	2.5 Bar
Nozzle opening pressure	250 Bar

When our fourth fault occurs, the vehicle will fail to start and a smell of fuel will be present. You may be able to get the engine to fire with the help of Bradex Easy Start and it will keep on running, but the problem will reoccur on the next start-up.

The problem is a leaking high-pressure fuel pump. If the ECU detects a drop in fuel pressure to below 300 Bar, it will not allow the engine to start.

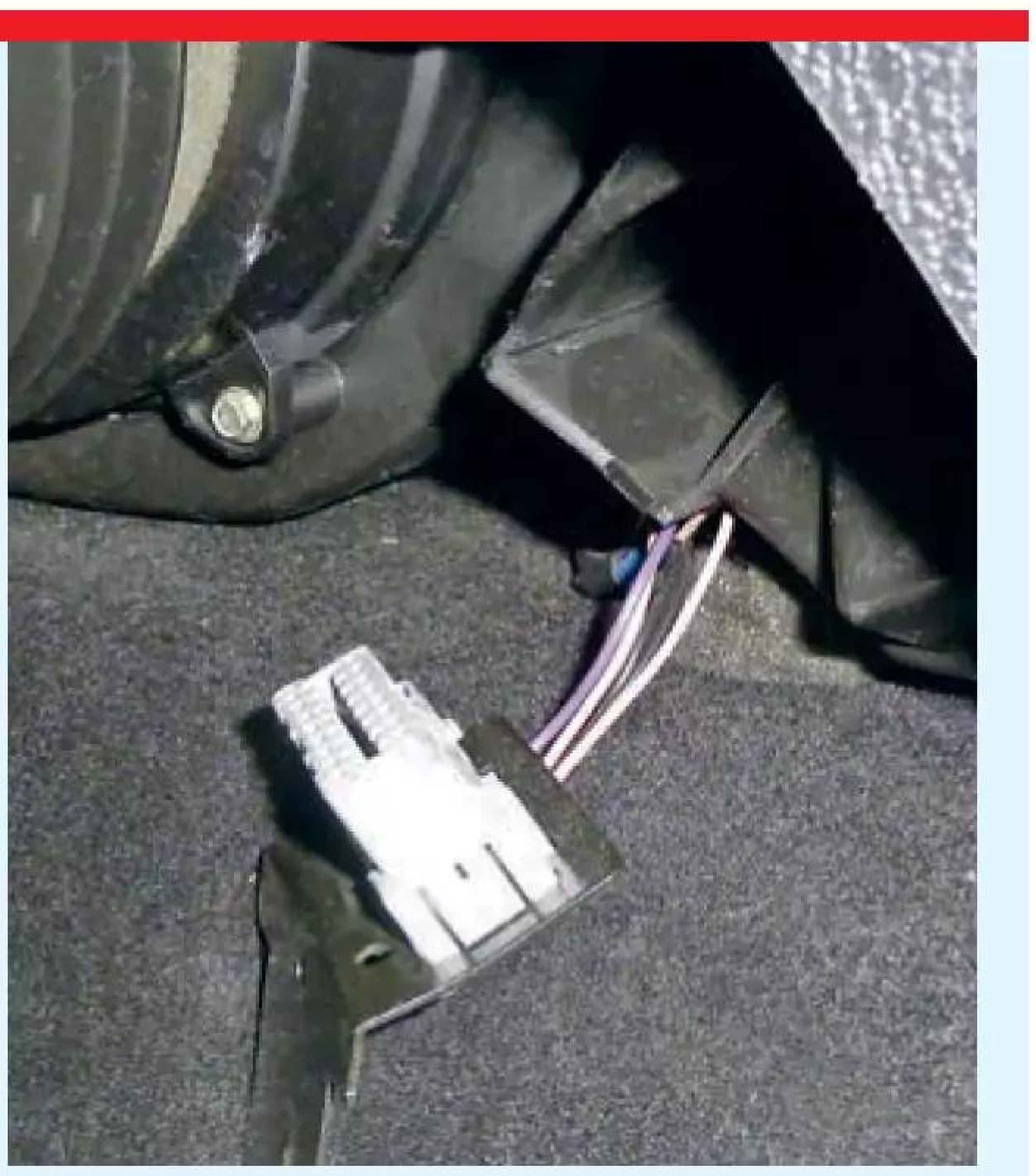
At the front of the engine, towards the right-hand side of the vehicle, you will see the high-pressure pump, buried deep down. Renewing the pump requires a special tool that sits in the timing chain cover, allowing the centre nut of the fuel pump to be released and pushed through. When this tool first appeared on the market it was very pricey, but it is now possible to buy cheaply on eBay or from motor factors. No coding is required for the replacement pump.

Fault 5:

FAULTY BRAKE LAMP SWITCH

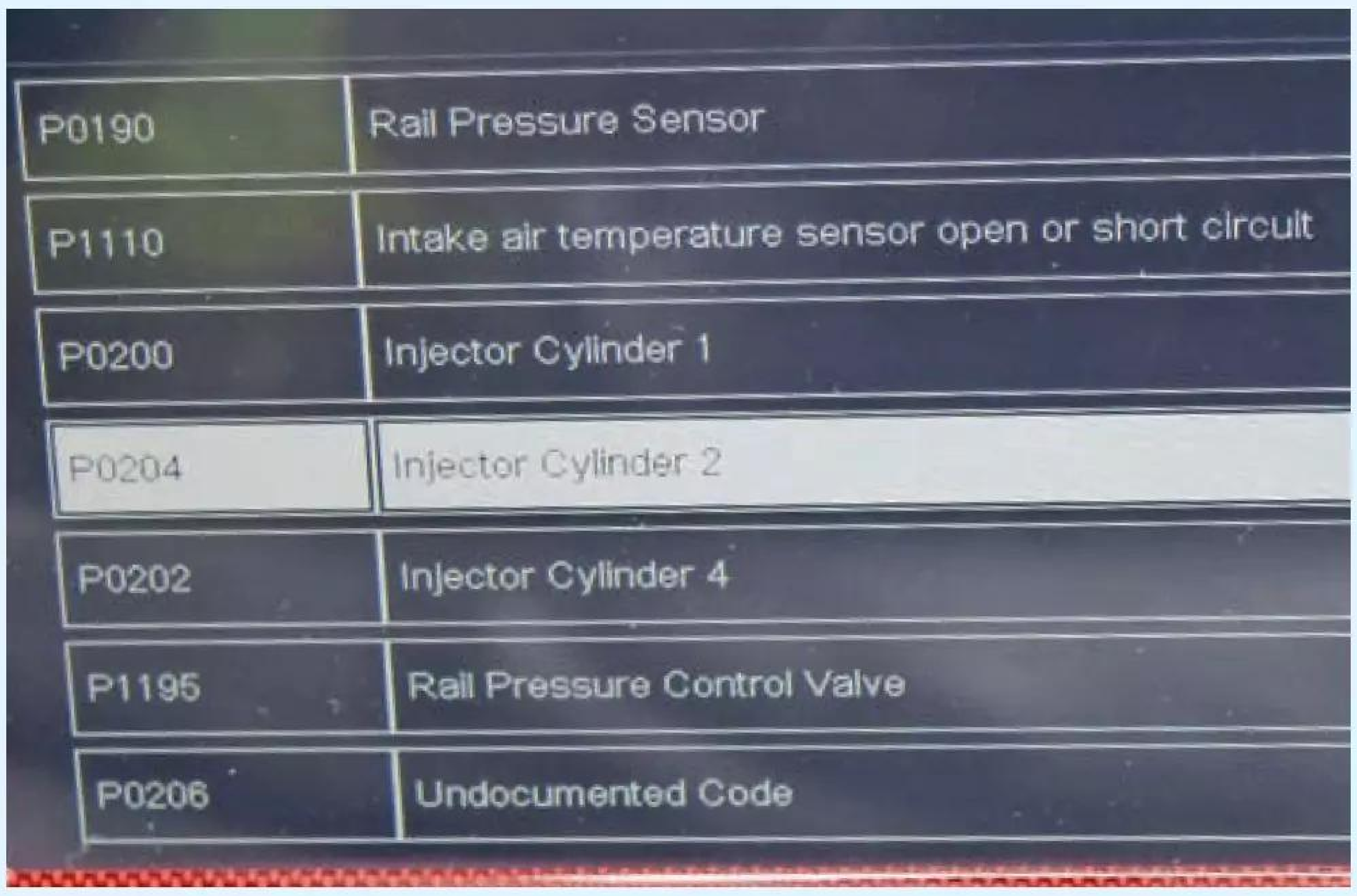
With our fifth fault, the hill descent, ABS and traction control warning lamp will illuminate. You may also find that the brake lamps are not working. The problem is a faulty brake lamp switch and renewing it will restore normal operation. Replacement is easy: just click the new unit in place.

10 ◀ There's an in-car fusebox located within the glovebox on the right-hand side of the vehicle. Check the assembly for condition and for moisture ingress.



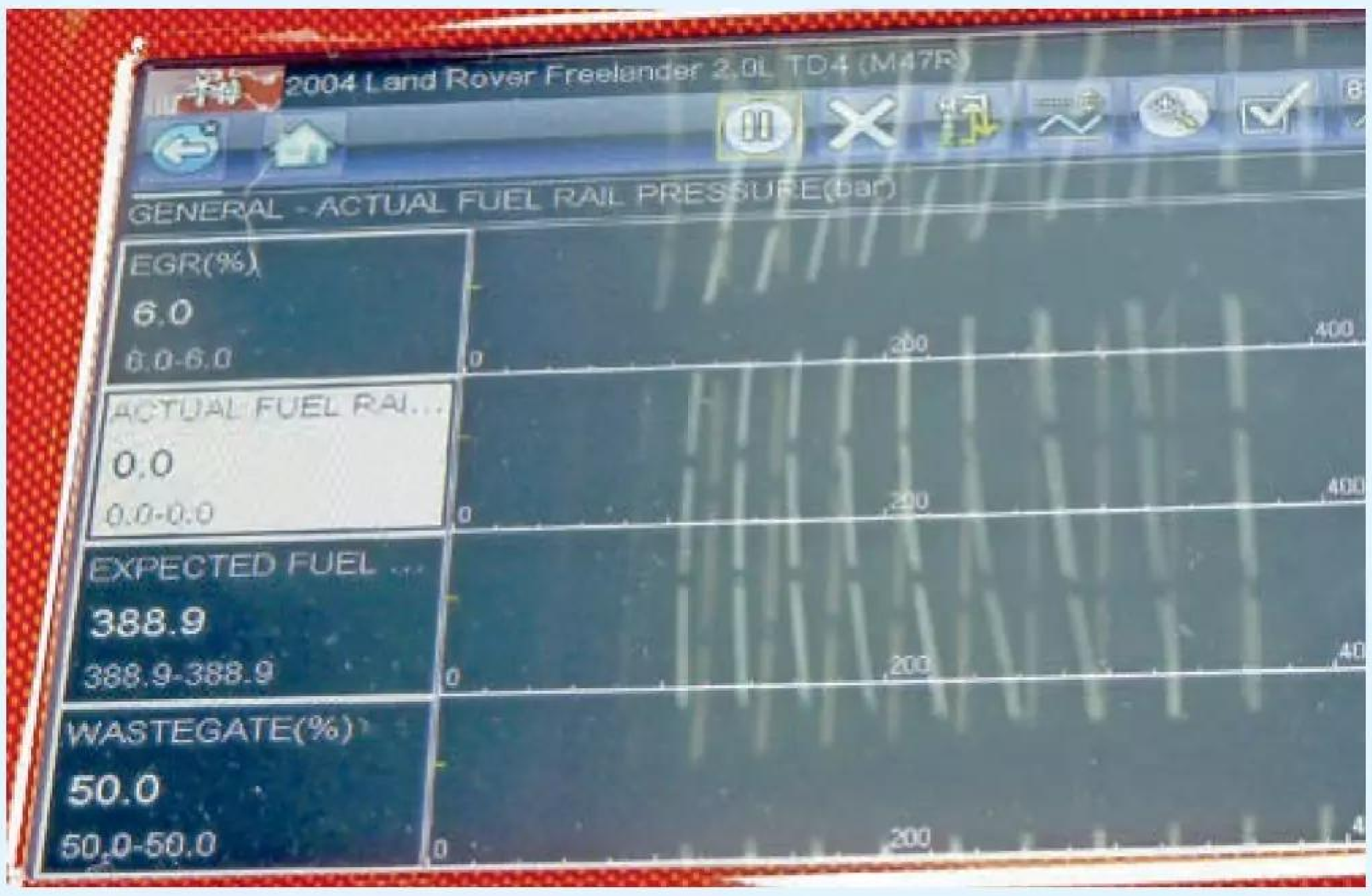
12 The diagnostic socket is on the left-hand side of the cabin, mounted on the centre console assembly. Check the cleanliness of the socket before plugging in your diagnostic equipment.

11 ▶ On this 2004 Freelander there's a secondary low-pressure fuel pump within a plastic case in the right-hand rear wheelarch; the fuel filter is also located here. In pre-2003 Td4s, the high- and low-pressure fuel pumps and the diesel fuel filter were in the engine bay.



P0190	Rail Pressure Sensor
P1110	Intake air temperature sensor open or short circuit
P0200	Injector Cylinder 1
P0204	Injector Cylinder 2
P0202	Injector Cylinder 4
P1195	Rail Pressure Control Valve
P0206	Undocumented Code

13 This screenshot on the Snap-on SOLUS Edge shows a variety of engine fault codes. With the fuel codes showing, further investigation is required, although they may be spurious.



2004 Land Rover Freelander 2.0L TD4 (M47R)

GENERAL - ACTUAL FUEL RAIL PRESSURE(bar)

EGR(%) 6.0 6.0-6.0

ACTUAL FUEL RAI... 0.0 0.0-0.0

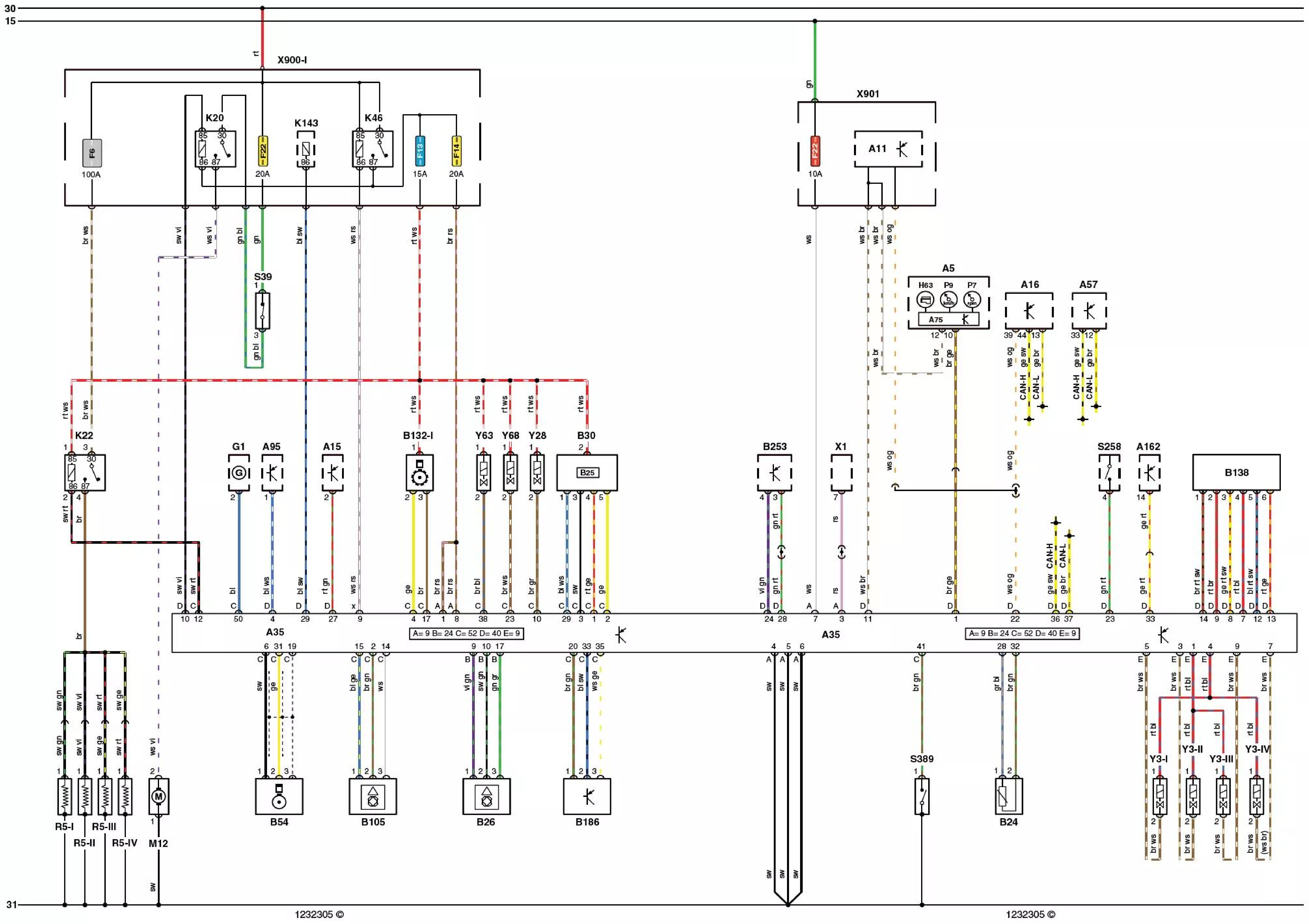
EXPECTED FUEL ... 388.9 388.9-388.9

WASTEGATE(%) 50.0 50.0-50.0

14 Live data displayed on the SOLUS Edge relating to fuel rail pressure. Fuel pump live data can be handy in a non-start situation. If the ECU doesn't register 250+ Bar, the engine won't start.

BOSCH CP1 CIRCUIT DIAGRAM

www.autodata-group.com


30
15
31
X900-I
F6
100A
K20
F22
20A
K143
K46
F13
15A
F14
20A
X901
F22
10A
A11
S39
A5
H63
P9
P7
A75
A16
A57
CAN-H
CAN-L
K22
G1
A95
A15
B132-I
Y63
Y68
Y28
B30
B25
B253
X1
S258
A162
B138
A35
A= 9 B= 24 C= 52 D= 40 E= 9
R5-I
R5-II
R5-III
R5-IV
M12
B54
B105
B26
B186
S389
B24
Y3-I
Y3-II
Y3-III
Y3-IV
1232305 ©

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A15	CRUISE CONTROL MODULE
A16	ABS CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A162	IMMOBILIZER CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B26	FUEL SYSTEM PRESSURE SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132-I	CAMSHAFT POSITION (CMP) SENSOR | 1
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B253	BRAKE PEDAL POSITION (BPP) SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
F	FUSE
G1	ALTERNATOR
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K20	FUEL PUMP (FP) RELAY
K22	GLOW PLUG RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
M12	FUEL PUMP (FP)
P7	TACHOMETER
P9	VEHICLE SPEEDOMETER
R5-I	GLOW PLUG | 1
R5-II	GLOW PLUG | 2
R5-III	GLOW PLUG | 3
R5-IV	GLOW PLUG | 4
S39	INERTIA FUEL SHUT-OFF (IFS) SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S389	ENGINE OIL PRESSURE SWITCH
X1	DATA LINK CONNECTOR (DLC)
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | 1
X901	FUSEBOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y28	EXHAUST GAS RECIRCULATION (EGR) SOLENOID
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y68	TURBOCHARGER (TC) WASTEGATE REGULATING VALVE
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

VW POLO BLUEGT 1.4 TSI

Tracing and fixing faults in electronic engine management systems

State-of-the-art technology was applied by Volkswagen's engineers for the Polo GT, but does this affect its diagnostic credentials adversely? **Kim Henson** and **Edward Haggar** find out.

NOTES: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

The Volkswagen Polo has been a popular compact hatchback since its launch in 1975, evolving through six generations so far. For this feature we are looking at the fifth-generation introduced in 2009, specifically the BlueGT version. This incorporates VW's BlueMotion technology, developed to improve fuel consumption and emissions performance. The car has a turbocharged 1.4-litre TSI engine endowed with Active Cylinder Technology (ACT), which seamlessly switches to operating on just two cylinders when running under light load conditions, saving petrol and cutting emissions. In theory, the car should return about 60mpg but, in everyday motoring, figures in the high 40s/low 50s are more realistic.

The example being examined here is a well looked-after car registered in October 2014. Our guide to the diagnostic aspects of this engine and its Bosch Motronic ME 17 management system is Edward Haggar.

Preparation

This VW is DIY-friendly in terms of maintenance requirements, with reasonable access around the power unit to items such as the air filter. The engine code is shown on a label attached to the cambelt cover. It is wise to make a note and/or take a photo of this label, while it is still legible. When ordering spares, it is useful to quote the engine code as well as the car's registration number.

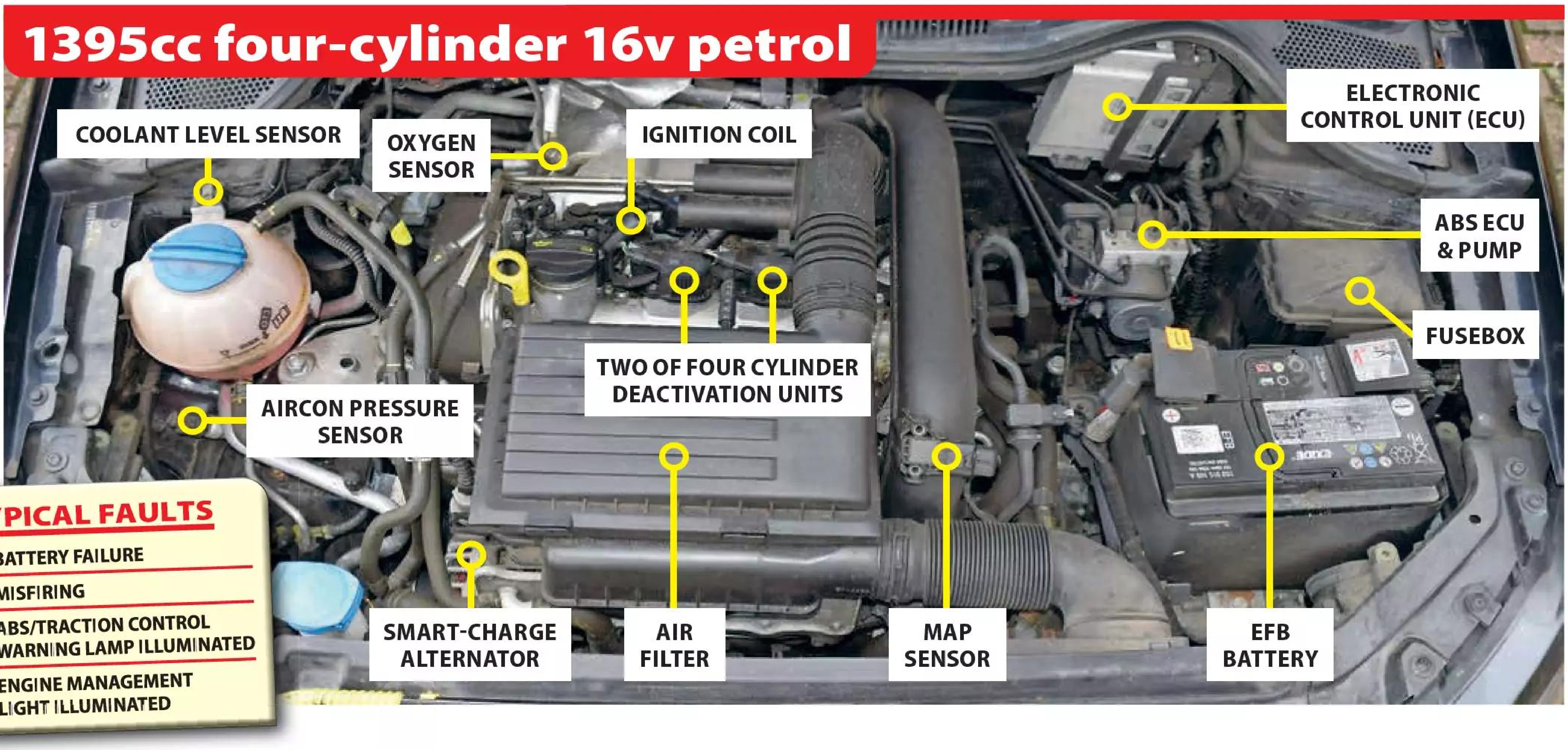
Fault 1

BATTERY ISSUES

As with many modern vehicles, the Polo BlueGT is equipped with an enhanced flooded battery (EFB) battery. These are more efficient than traditional lead-acid batteries, especially in vehicles fitted with sophisticated electrical systems, notably Stop-Start technology. When the time comes to renew the battery, it is essential that the battery is of the specified type and that it is programmed to the vehicle.

EFB batteries require special testing and specific chargers. Modern batteries – not just those fitted to Volkswagens – are failing more quickly than previously, probably due to stop/start driving and the reliance on electrical power by the car's different systems. The good news is that while EFB batteries were once really expensive, they are better priced today.

1395cc four-cylinder 16v petrol



TYPICAL FAULTS

① BATTERY FAILURE
② MISFIRING
③ ABS/TRACTION CONTROL WARNING LAMP ILLUMINATED
④ ENGINE MANAGEMENT LIGHT ILLUMINATED

If you simply replace the battery and don't tell the battery management system that you have fitted a new one, it's likely it will kill the new battery more quickly. Over time, as the battery ages, it requires more electrical draw and the charging system has to work harder to keep pace with power requirements. The car's charging system adapts to this and, upon fitting a new battery, it will continue to charge the battery at the same level as the old, ailing one unless told otherwise. Battery programming is simple enough and most quality diagnostic tools will carry out this function – you simply follow the procedure indicated. Remember also that, after battery replacement, the vehicle's side windows will require resetting.

Technical Specs

Actual values

Component	Value
Injector resistance	3 ohms (note the low resistance)
Crank sensor supply	5 volts
Oxygen sensor heater circuit	4.2 ohms
Low fuel pressure	4-7 Bar
Main fuel pressure	120 Bar
Engine coolant sensor (at 34°C)	1600 ohms
Engine coolant sensor (at 100°C)	200 ohms

Fault 2

SPARK PLUGS/ IGNITION COILS

When this fault occurs on this Polo, typical symptoms include a loss of power, plus the illumination of the engine management system warning light. Fault codes will be stored for the relevant cylinder misfire.

First, remove and inspect the spark plugs, because many people these days tend to see the term 'long-life' and skip changing them. While such spark plugs last longer than years ago, they still wear out, and the longer they are left in the engine beyond their change period as laid down in the service schedule, the more strain they will put on the ignition coils. Not renewing plugs as required can result in a coil burning out.

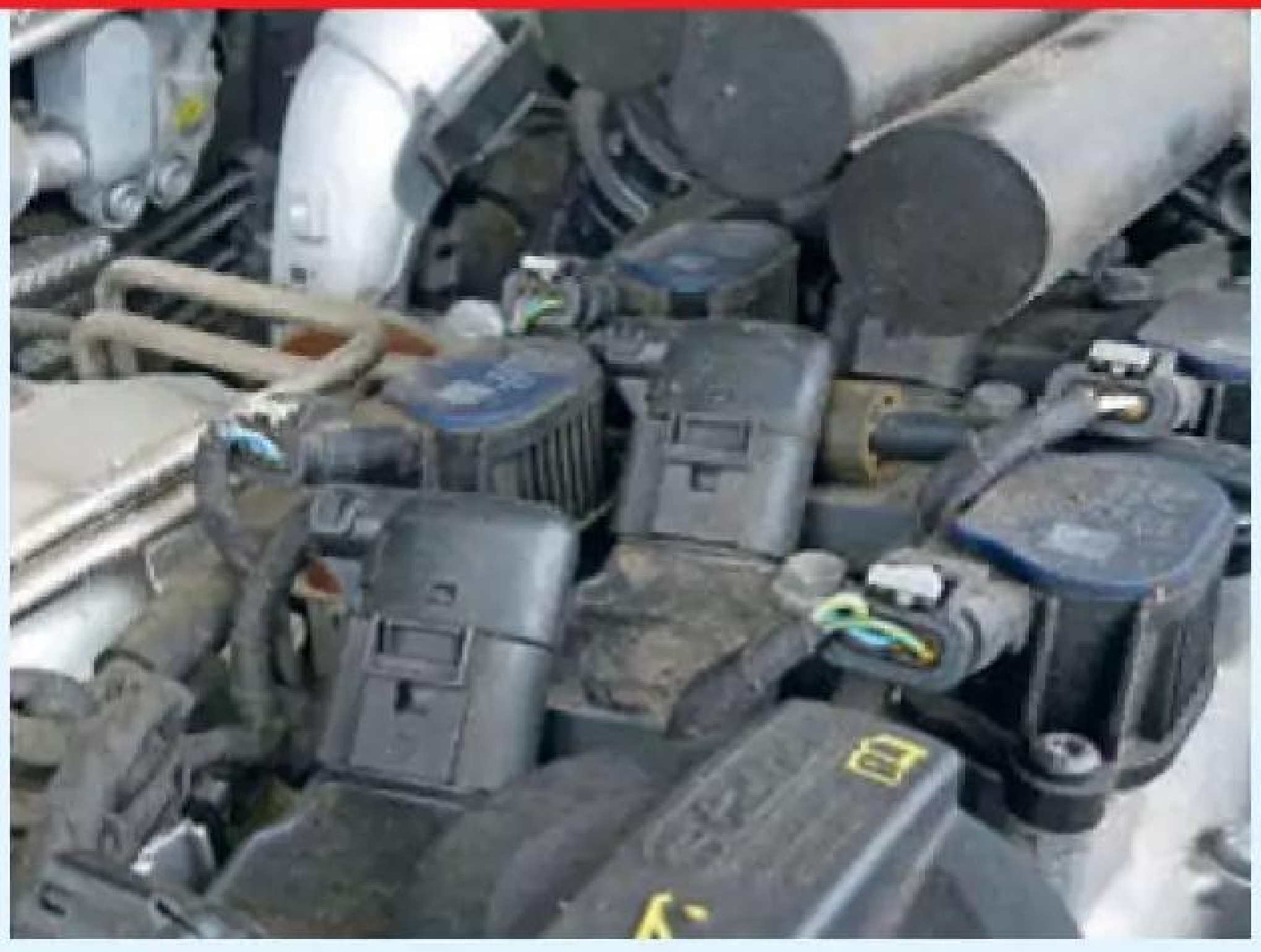
If the plugs are OK and the misfire is still present, you need to check the coils. A quick test is to swap the coil to another cylinder to see if the misfire moves with it. Alternately, if available, an oscilloscope can pinpoint any primary and secondary ignition faults.

Fault 3

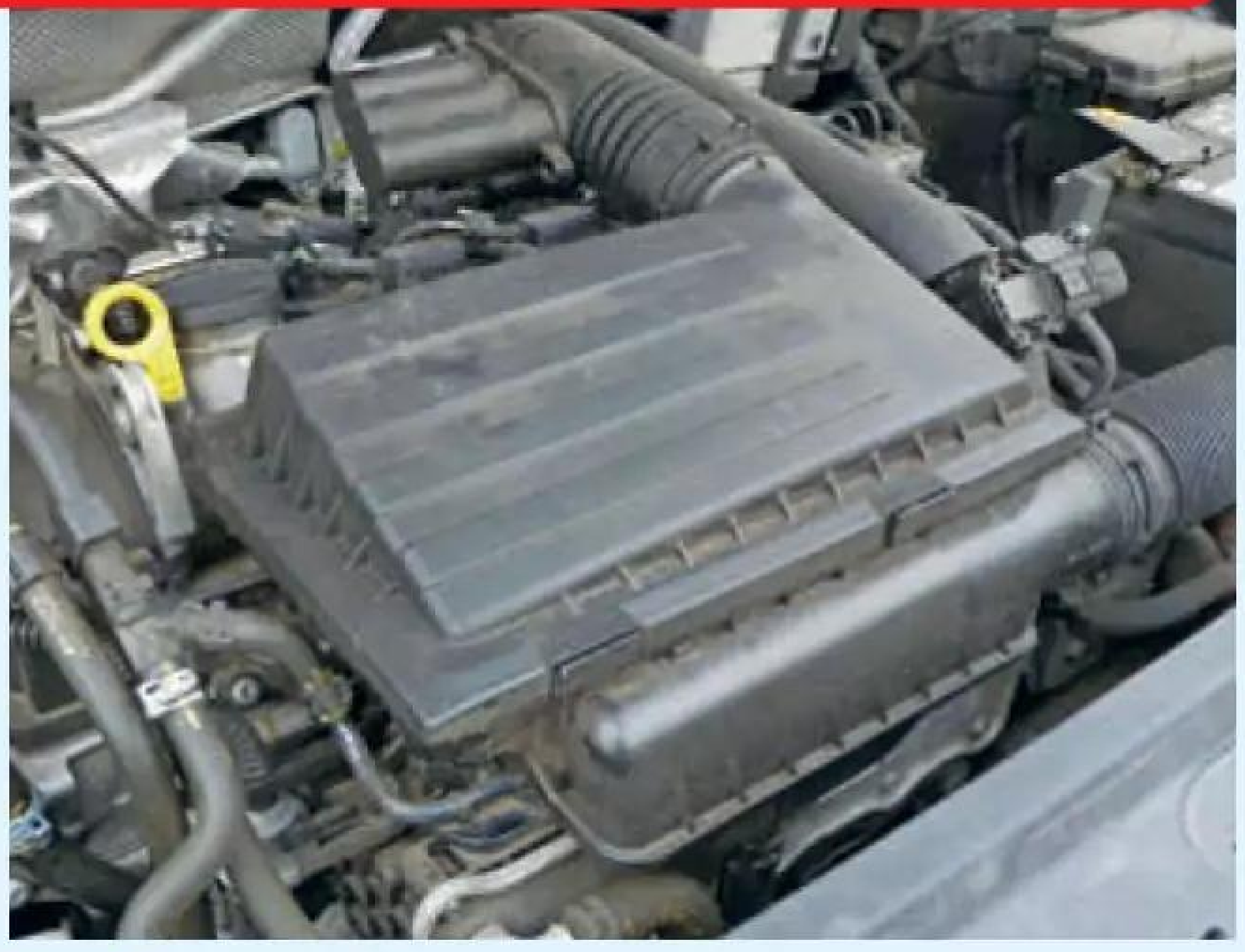
FAILED ABS SENSOR

If the ABS/traction control warning light is illuminated, together with a possible hesitation from the engine that some people describe as a misfire – carry out a diagnostic fault check of the ABS system.

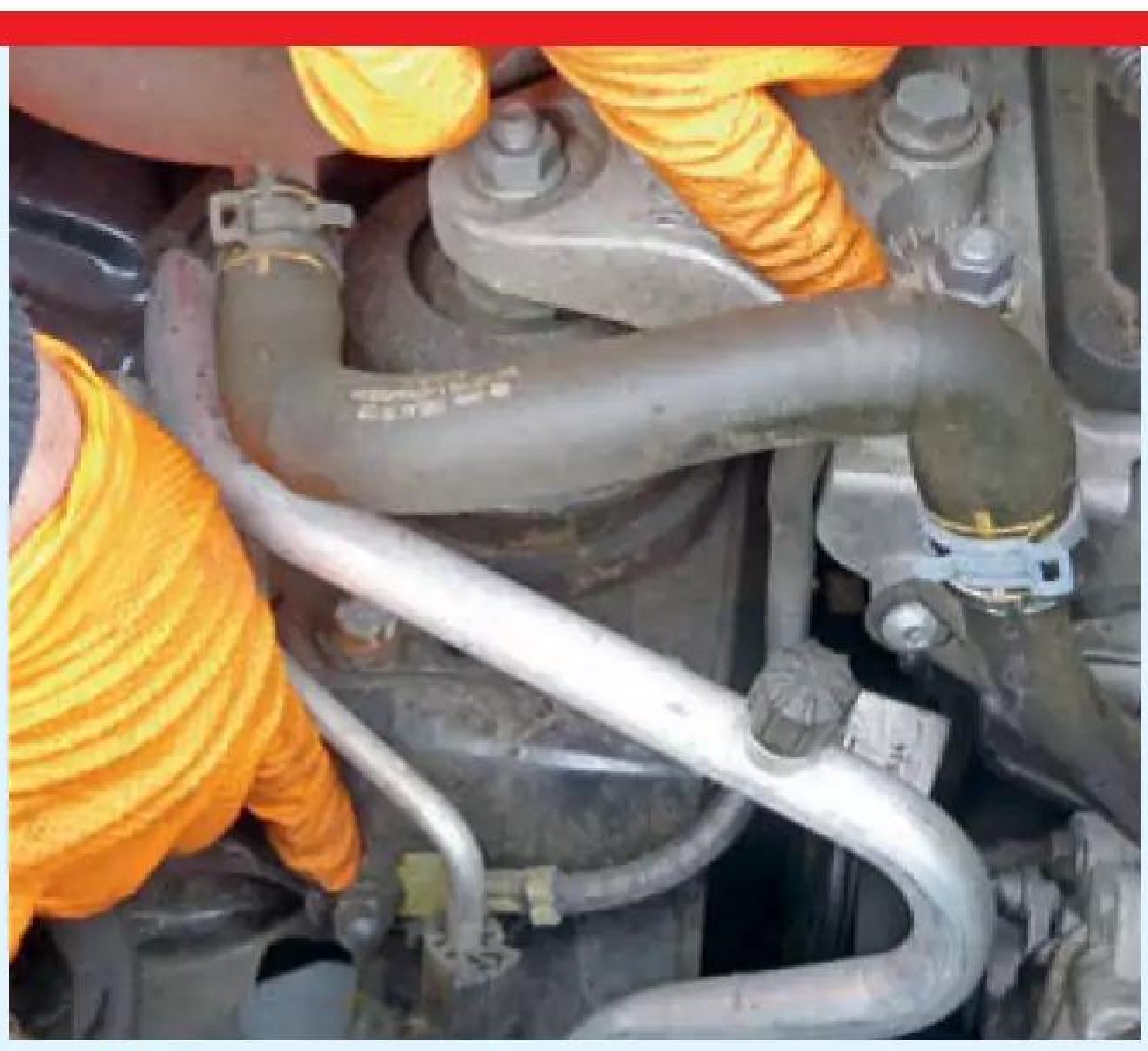
Typical Volkswagen Polo components



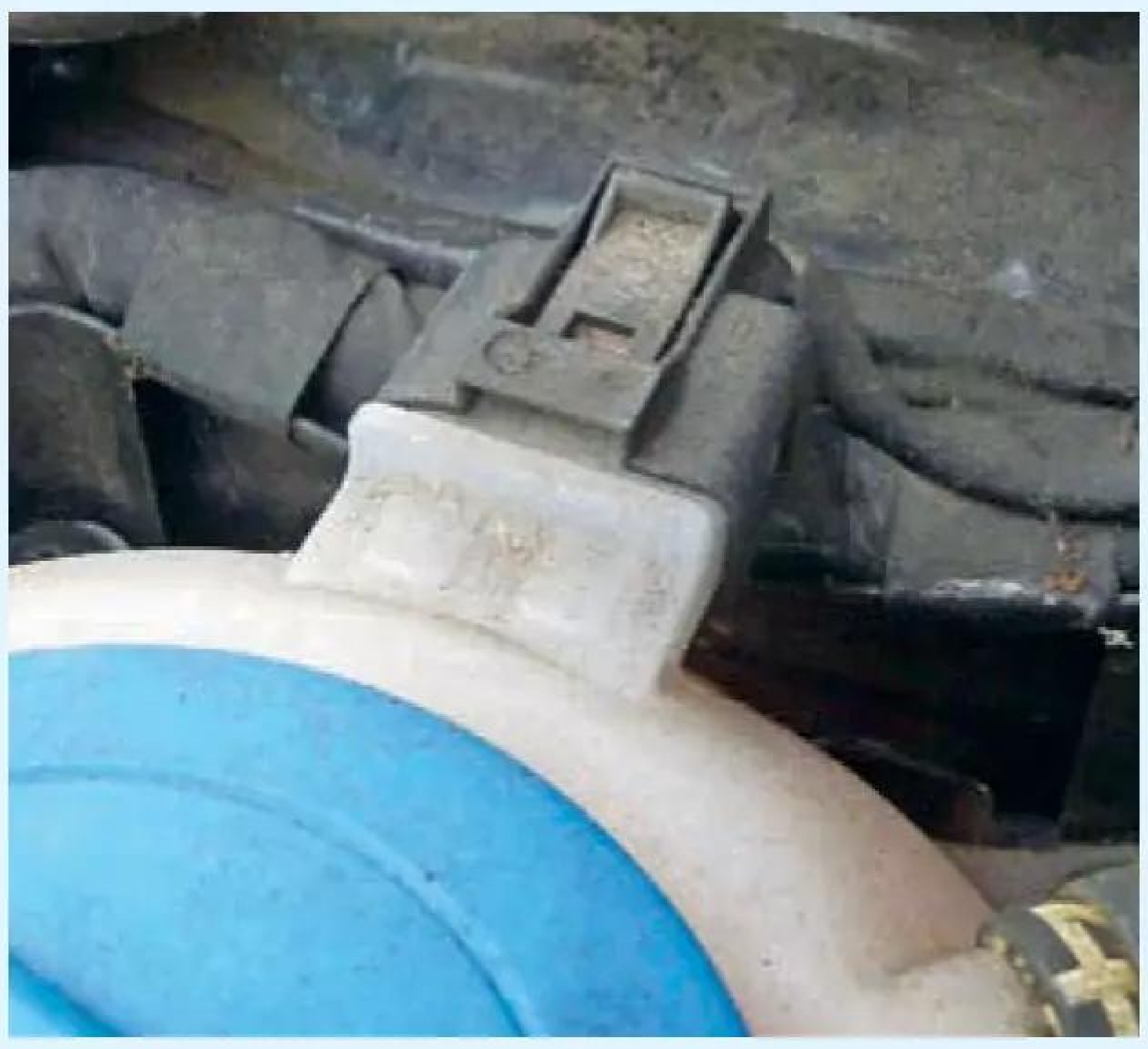
1 The ignition coil for cylinder No 4 is obscured by plastic trunking above it; release the two spring clips securing the trunking and move it aside. A single bolt (10mm) holds each coil. Carefully rotate each coil to the left, then the right, to release; take care as the coils can split.



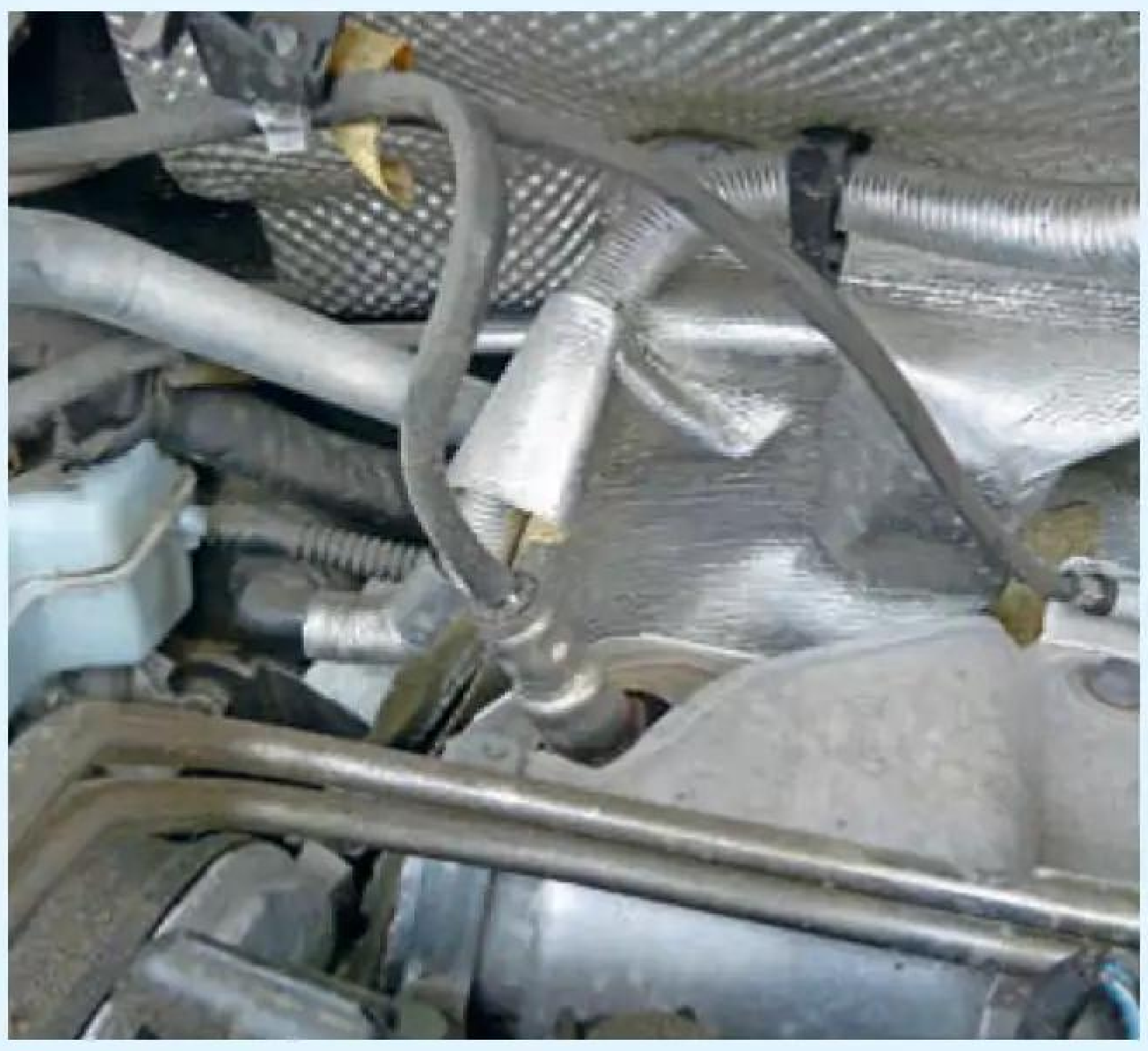
2 The air filter assembly is very easy to reach at the top of the engine. It's essential to note that the four screws securing the lid are facing upwards (ie, they are unscrewed downwards, from below the protruding flange around the perimeter).



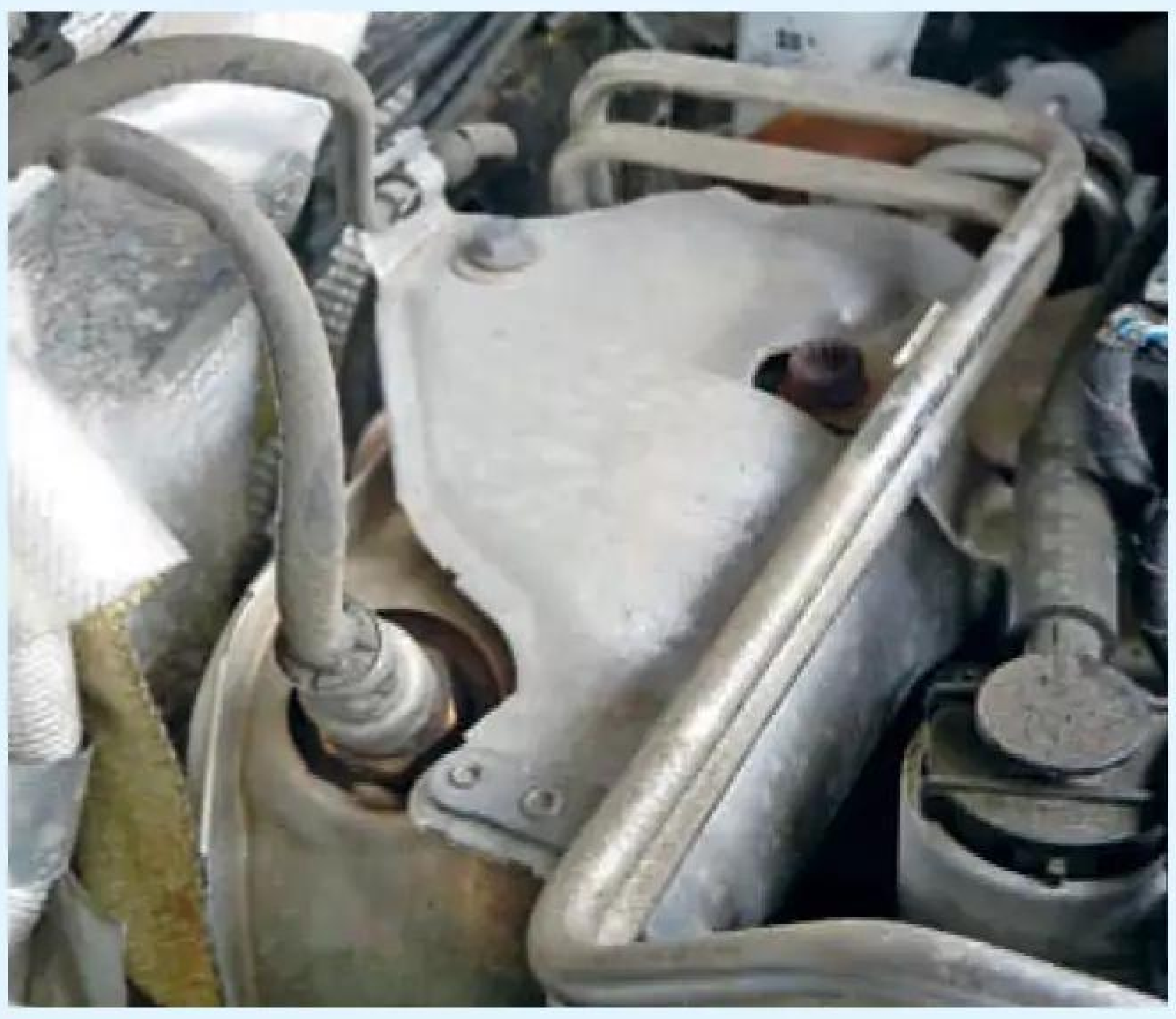
3 These are two important earthing points on the engine. Check that the cables are secure and that the connections are clean and free from corrosion. If necessary, separate the connections, clean and reassemble them, applying silicone protectant.



4 There's a coolant level sensor attached to the reservoir. The sensor is linked to a warning lamp on the dash, which activates if the level drops. On early models, these sensors sometimes played up, indicating low coolant level even when it was fine.



5 In the centre of this photograph can be seen the oxygen/O2/Lambda sensor at the rear of the engine. Check the condition of the sensor and the wiring connected to it, ensuring that it is securely in place.



6 To aid rapid warm-up and lower emissions, this engine's turbocharger is built into the exhaust system, close to the motor at the rear of the engine bay. For optimum turbo life it's essential to use the specified engine oil and to change it frequently.

ENGINE MANAGEMENT

The Bosch Motronic ME 17 management system used in this Polo incorporates these primary components:

- Engine ECU, located in the engine bay
- Digital camshaft and crankshaft sensors
- Oxygen sensors post- and pre-catalytic converter
- Knock sensor, attached to the engine block
- Solenoid-type fuel injectors
- Pencil-type ignition coils
- ABS ECU and pump, located in the engine bay
- Low-pressure fuel pump, situated the in fuel tank
- High-pressure fuel pump, located on the side of the cylinder-head
- MAP sensor, fitted in air trunking
- Coolant level sensor, positioned in the reservoir
- Accelerator pedal position sensor, mounted on the pedal
- Brake pedal position sensor, located on the pedal

You will likely see fault codes relating to 'wheel speed sensor signal incoherent'.

Access the sensor to check for any damage or something trapped in the vicinity that could be affecting the signal. If all is OK in these respects, look at live data in the ABS ECU. For this test, a second person is required to either observe the live data or drive the car. In the ABS ECU checklist, you will see an option for 'live data of the wheel speed sensors'; select 'all' so you can access all of them at the same time.

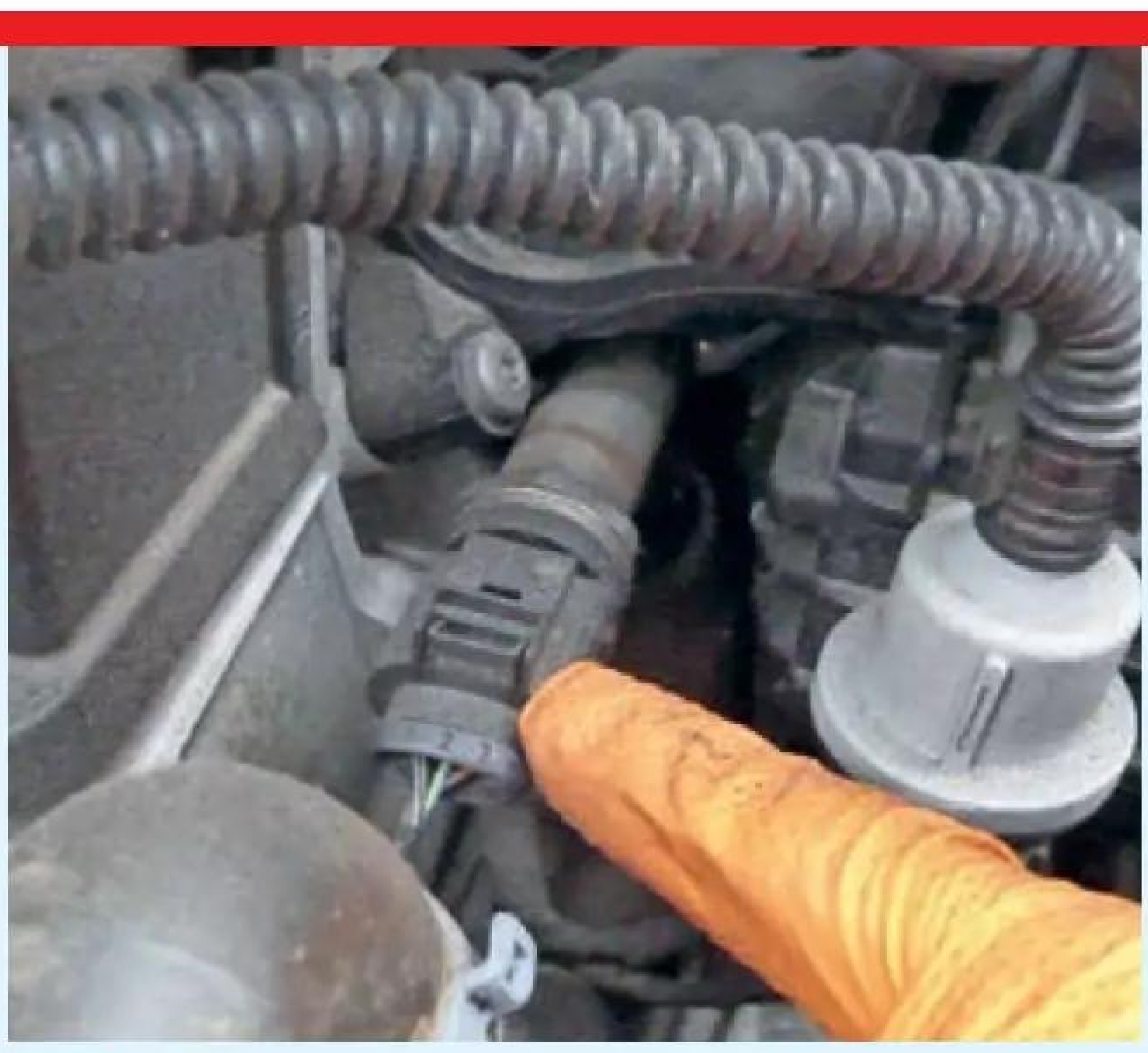
In our experience, when these sensors play up, they begin to act very erratically (for example, one wheel will be shown rotating backwards while the others are going forward). Further testing will require the use of an oscilloscope.

Always fit decent-quality sensors. In a recent case, the motorist changed the sensor and the warning lamp was still illuminated. Further investigation established that a poor-quality sensor had been fitted. Once it was replaced with a genuine sensor, the fault went away.

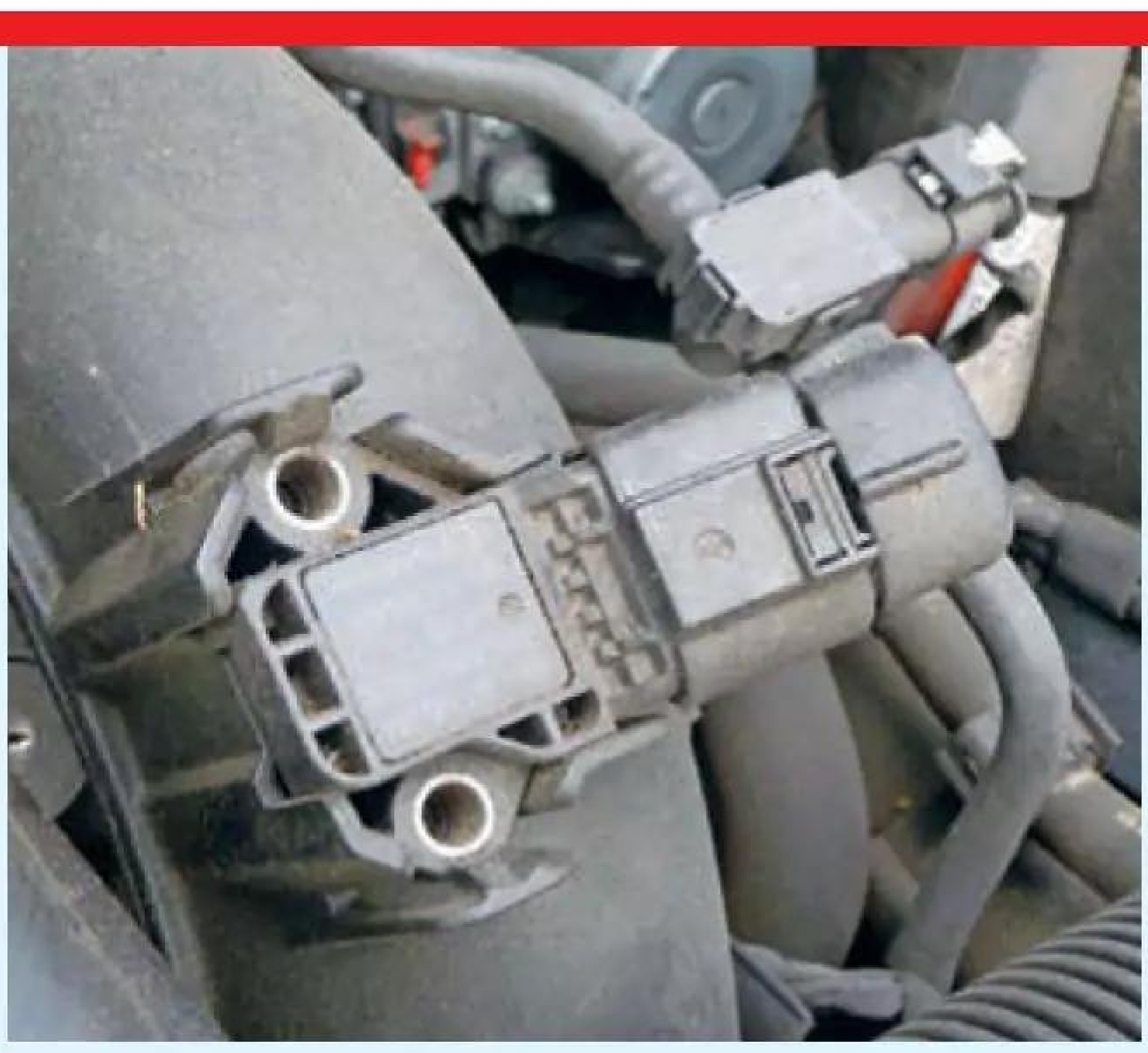
Fault 4

INCORRECT CAM TIMING

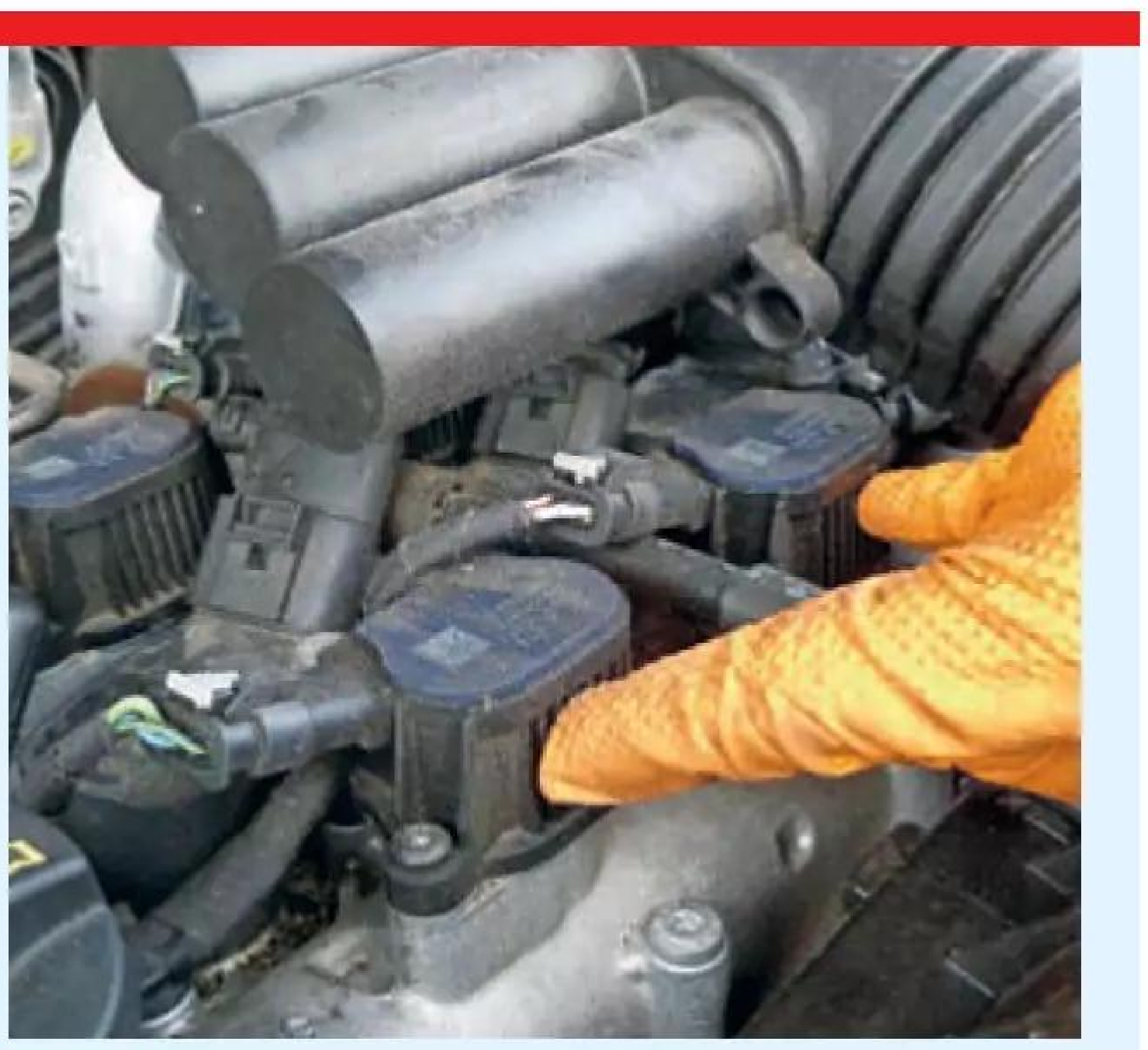
This fault can result from not correctly locking the engine/cam sprockets when renewing the cambelt. A recent case concerned a Polo that always had the



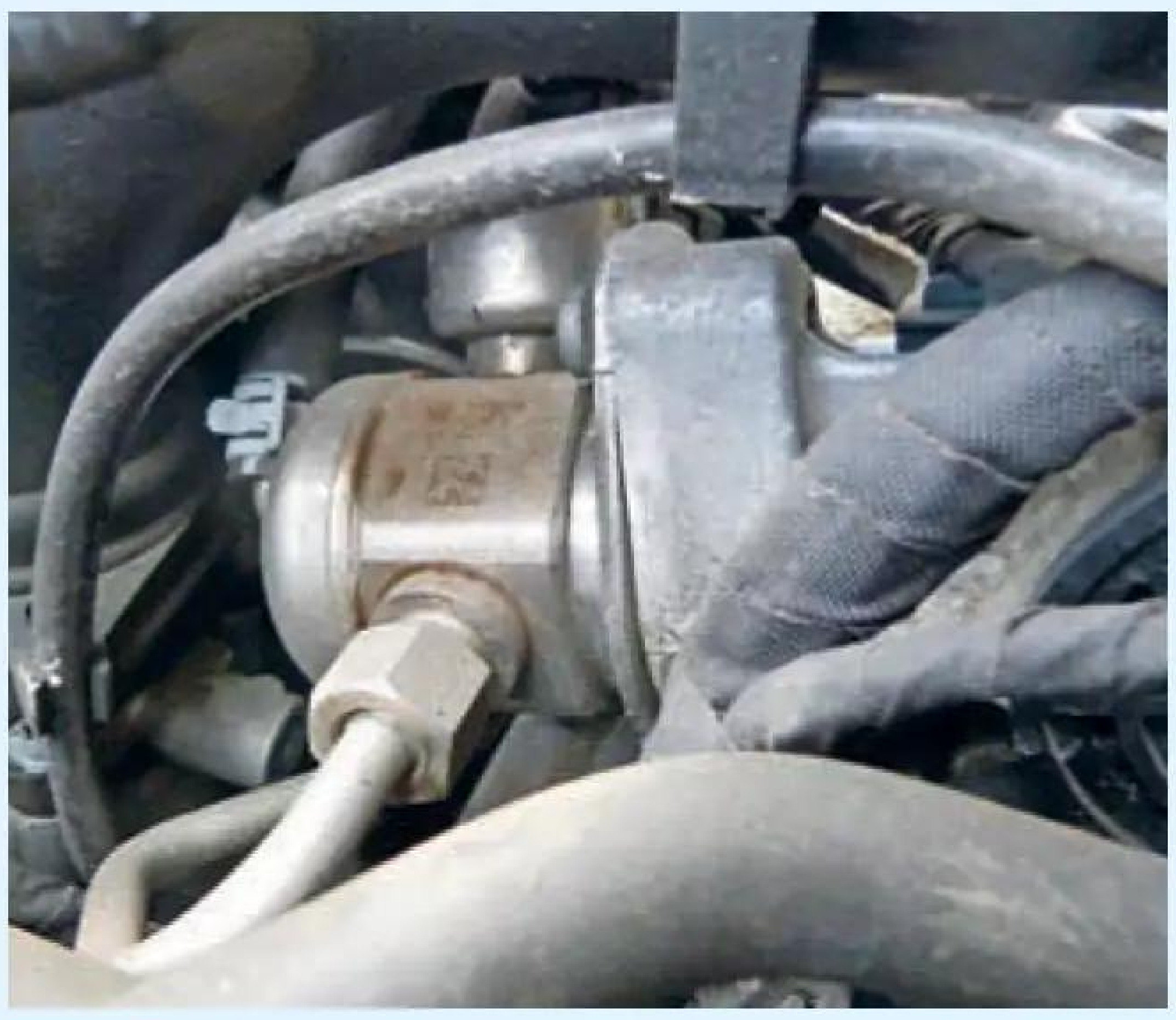
7 Indicated here is the fuel pressure sensor, located at the right-hand end of the fuel rail. The sensor's function is to transmit the pressure within the rail to the ECU. In turn, the ECU adjusts the supply of fuel to the engine.



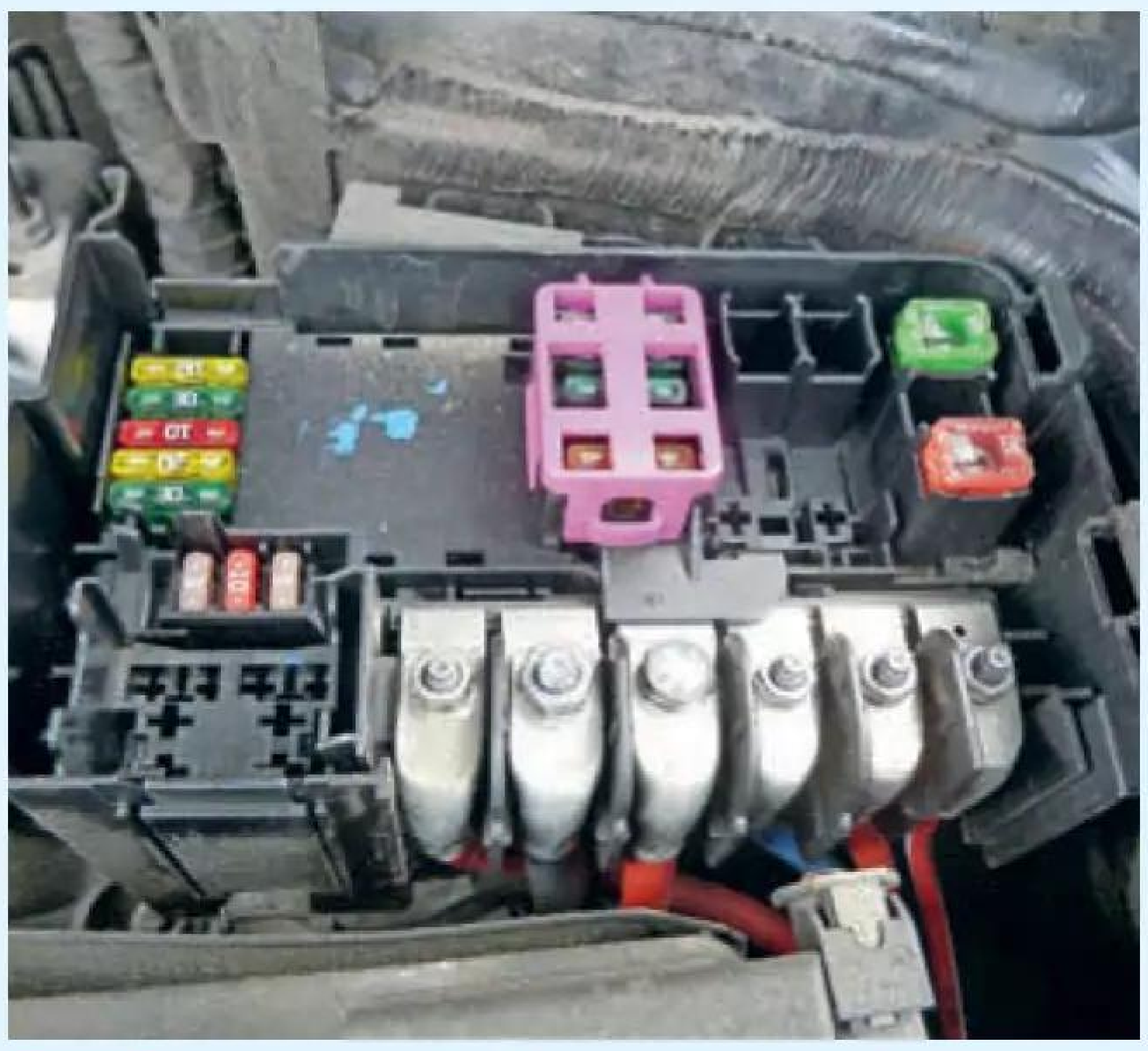
8 The mass absolute pressure (MAP) sensor is located within the intake trunking, towards the left-hand top of the engine compartment. Its job is to monitor the pressure within the inlet manifold at all times, enabling the ECU to adjust fuelling levels.



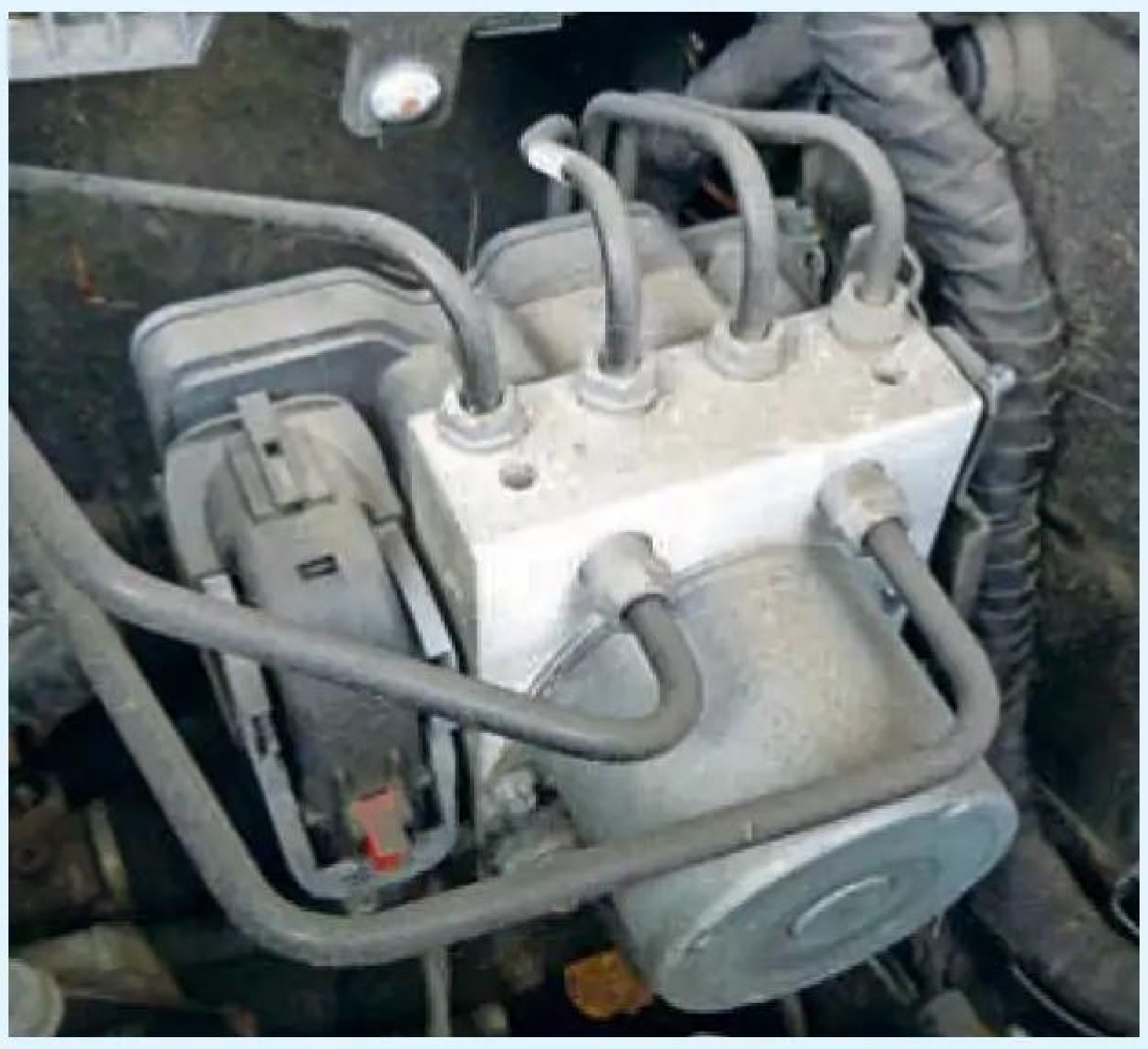
9 These are two of the four cylinder deactivation units incorporated within the Polo's engine. These operate in conjunction with special profile camshafts, to take two cylinders out of action under light engine load/cruising conditions.



10 The gear-driven high-pressure fuel pump is positioned alongside the cylinderhead, on the left-hand side. It requires high pressure to operate, so if low pressure is detected the engine will not start. It's essential that any fuel leaks are dealt with immediately.



11 Positioned adjacent to the left-hand front suspension turret is the underbonnet fusebox/connection box. Always ensure that its lid is correctly fitted, to prevent the ingress of moisture.



12 The ECU and pump assembly for the ABS anti-lock brake system is located on the left-hand side of the engine bay. Check for component integrity, connection security and any signs of hydraulic fluid leaks.

⇨

engine warning lamp lit. Upon checking the vehicle, numerous fault codes were recorded for cam and crank signals, with the ECU noting a difference in the signals. At this point, we spotted a sticker in the engine bay relating to a recent cambelt change.

These days, engines are set up to a fine tolerance, hence the need for locking pins when renewing a cambelt. We borrowed the correct tools (the relevant part numbers follow) and found that the belt set-up was half-a-tooth out. This triggered a fault code because the ECU had judged that the correlation wasn't right, even though the timing wasn't far enough adrift to cause noticeable running issues. Whoever had carried out the cambelt renewal risked the timing being incorrect by not using the proper tools for the job. Upon adjusting the cam timing to the correct position and resetting the warning light, the fault disappeared.

Special tools required for a cambelt change on the Polo BlueGT include:

USEFUL PREPARATION DATA

These are the official recommended change intervals for the various components. However, we strongly recommend that the service/change intervals are halved at least.

SERVICE INTERVALS
Every 10,000 miles or annually, whichever comes first.

Engine oil Every 10,000 miles or 12 months, whichever comes first.

Oil Type SAE 0W-30 fully-synthetic (VW 502.00). It's essential that only the correct specification oil is used.

Capacity ('service' fill) 4.0 litres.

Oil filter torque figure 20Nm

Cambelt Every five years, at least.

Air filter Every 60,000 miles or six years, whichever comes first.

Sump plug torque figure 30Nm

Brake fluid Every two years.

Spark plugs Every 40,000 miles or four years.

Auxiliary drivebelt tensioner locking pin (part no T10060A)

Assembly tool (part no T10487)

Camshaft sprocket holding tool (part no T10172)

Camshaft sprocket holding tool adaptor (part no T10172/1)

Camshaft timing check pin (part no T10504/2)

Camshaft timing tool (part no T10504)

Crankshaft locking tool (part no T10340)

Camshaft timing tool locking pin (part no T10504/1)

Crankshaft pulley holding tool (part no T10475)

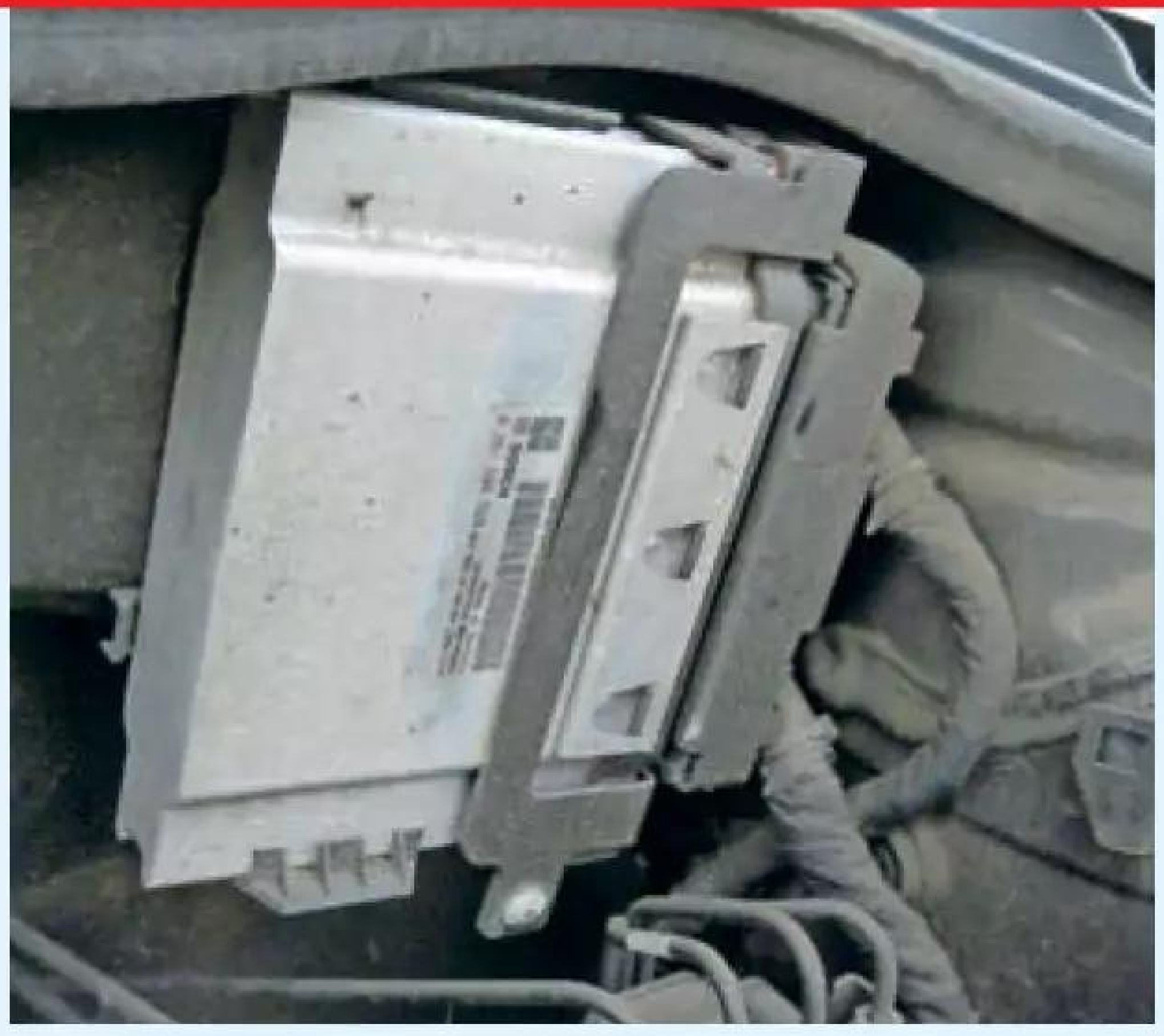
Tensioner pulley holding tool (part no T10499)

Torque wrench (part no VAS 6583)

Tools for releasing intercooler pipe clips (part nos T10527 & T10527/1)

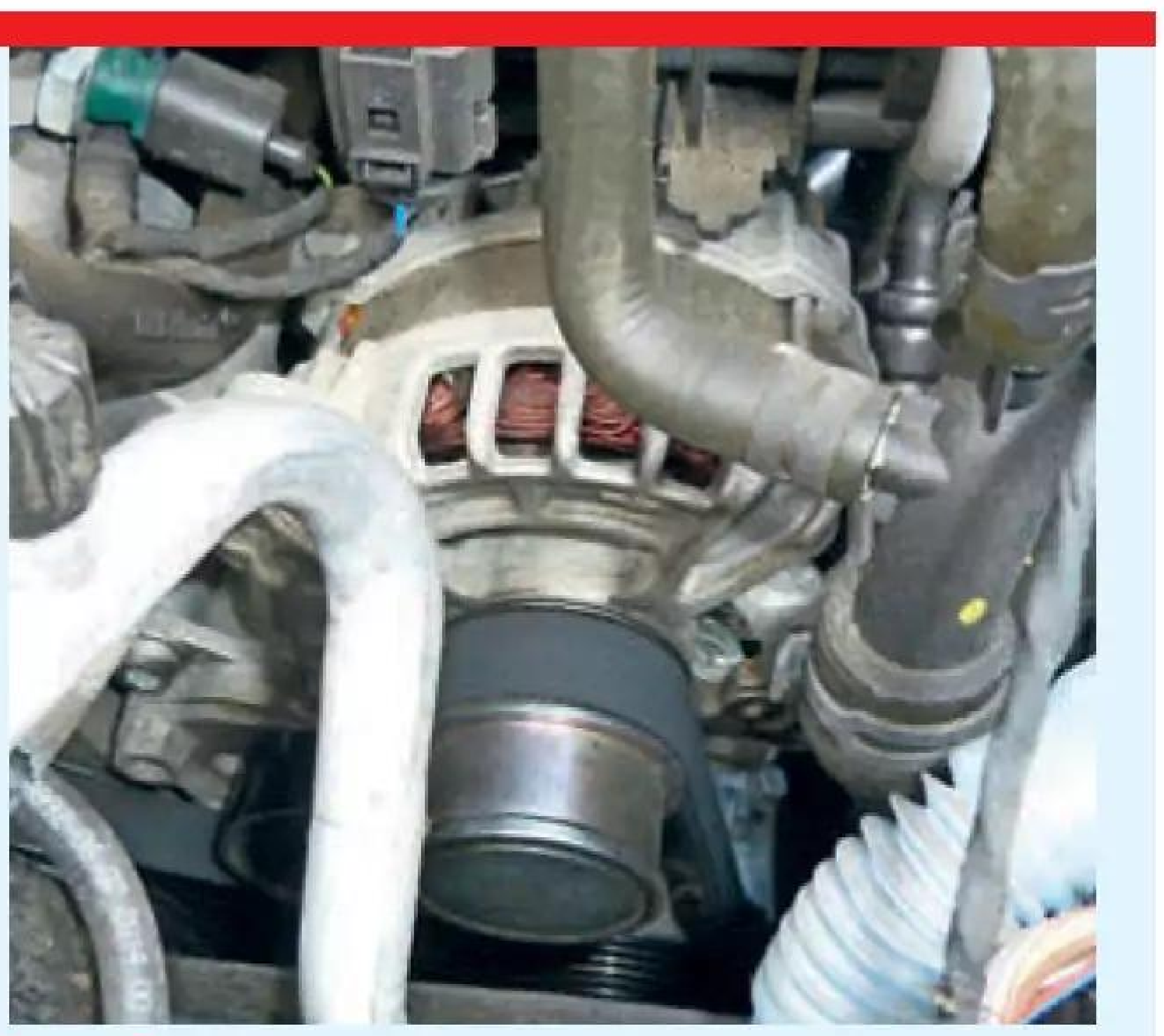
Tool for slackening/tightening tensioner pulley bolt (part no T10500)

Typical Volkswagen Polo components

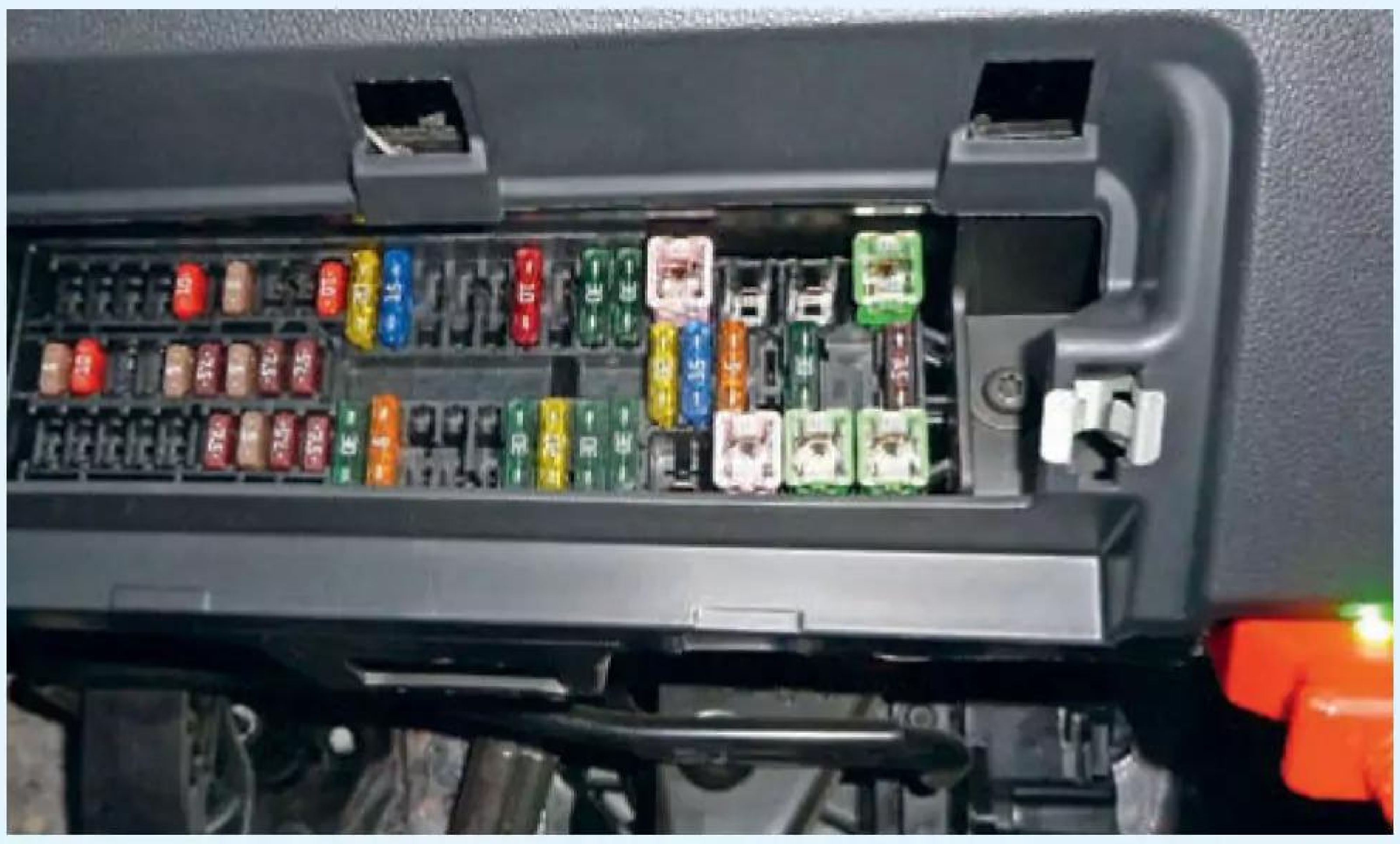


13 **The vehicle's main ECU is found at the back of the engine bay, on the rear bulkhead and just above/behind the ABS system's ECU and pump assembly. Check for moisture ingress and ensure that all the cables/connections are sound.**

14 **It is essential that only the correct enhanced flooded battery (EFB) is used on this Polo. This type of battery ensures greater durability and charge acceptance when operating in a low state of charge (for example, in cars with stop/start systems). This battery incorporates a visual indicator showing battery condition.**



15 **A Smart Charge alternator is employed, which adjusts the level of battery charging depending on the temperature of the engine, delivering a higher charge rate at lower temperatures. To avoid damaging the system, never jump-start a vehicle with a Smart Charge set-up if the battery is discharged.**

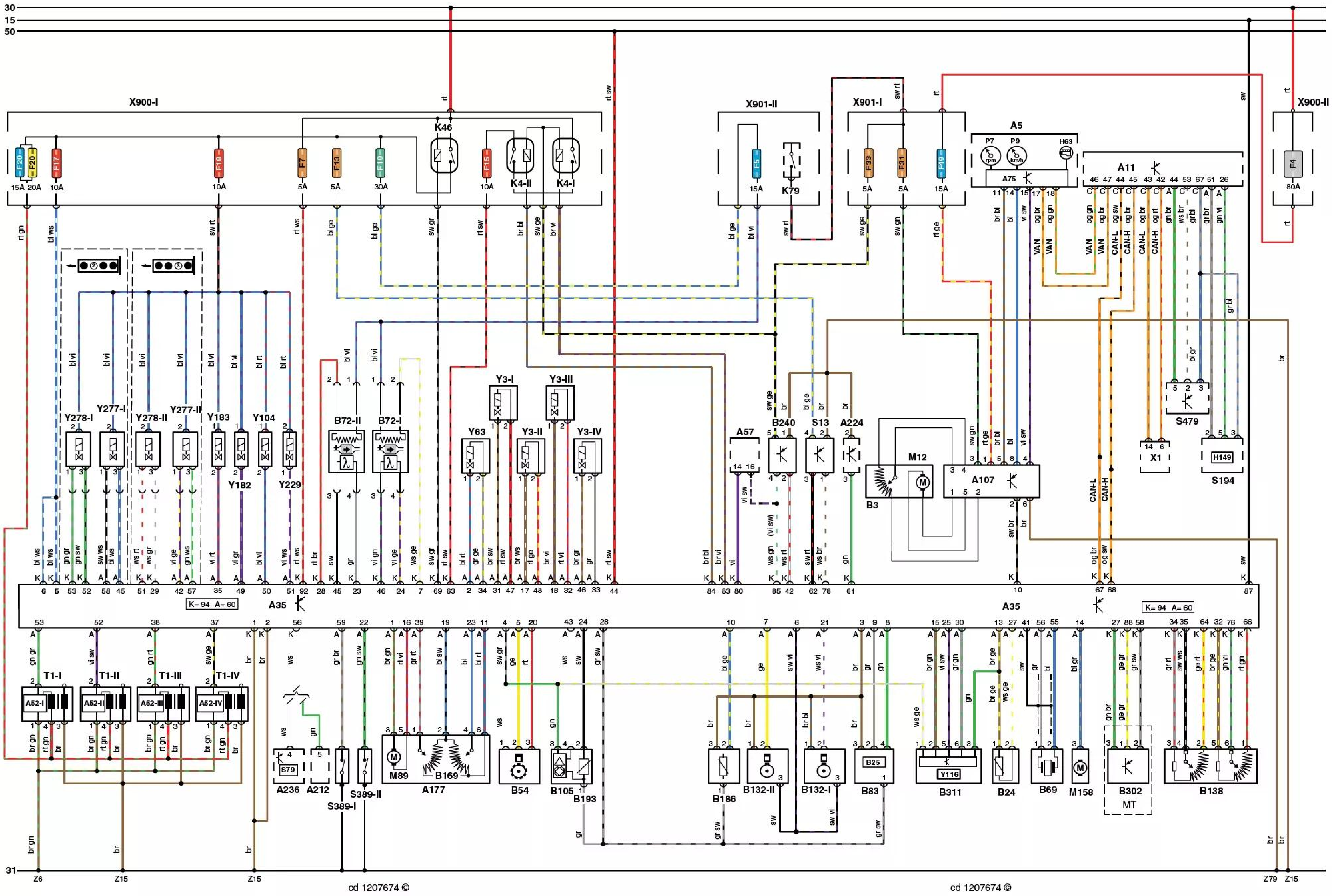


17 **There is an in-car fusebox built into the fascia assembly, normally concealed by a plastic clip-on cover. Just visible at the right of this shot is the plug for the Snap-on SOLUS Edge tool, which can be plugged into the diagnostic socket for system interrogation.**

18 **The Volkswagen Data Plug system links to the dealer, monitoring operation of the management system and highlighting faults that may arise. The app can be loaded onto the owner's smartphone and records all manner of data, including where the car is located. It can offer tips on how to drive more economically and, if in a breakdown situation, it will notify the emergency service/dealer.**

BOSCH MOTRONIC ME 17 CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
50
X900-I
F20
F17
F18
F7
F13
F16
F15
K46
K4-II
K4-I
15A 20A
10A
5A
30A
X901-II
F5
K79
X901-I
F32
F31
F40
A5
P7
P9
H63
A75
A11
X900-II
F4
80A
Y278-I
Y277-I
Y278-II
Y277-II
Y183
Y104
Y182
Y229
B72-II
B72-I
Y3-I
Y3-III
Y63
Y3-II
Y3-IV
A57
B240
S13
A224
M12
B3
A107
S479
X1
H149
S194
A35
K= 94 A= 60
T1-I
T1-II
T1-III
T1-IV
A52-I
A52-II
A52-III
A52-IV
S79
A236
A212
S389-II
S389-I
M89
B169
A177
B54
B105
B193
B186
B132-II
B132-I
B25
B83
Y116
B311
B24
B69
M158
B302
MT
B138
31
Z6
Z15
Z15
Z79 Z15
cd 1207674 ©
cd 1207674 ©

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A52-I	IGNITION AMPLIFIER | 1
A52-II	IGNITION AMPLIFIER | 2
A52-III	IGNITION AMPLIFIER | 3
A52-IV	IGNITION AMPLIFIER | 4
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A107	FUEL PUMP CONTROL MODULE
A177	THROTTLE CONTROL UNIT
A212	STEERING WHEEL FUNCTION CONTROL MODULE
A224	ENGINE OIL SENSOR MODULE
A236	STEERING COLUMN FUNCTION CONTROL MODULE
B3	FUEL GAUGE TANK SENSOR
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B69	KNOCK SENSOR (KS)
B72-I	HEATED OXYGEN SENSOR (HO2S) | 1
B72-II	HEATED OXYGEN SENSOR (HO2S) | 2
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132-I	CAMSHAFT POSITION (CMP) SENSOR | 1
B132-II	CAMSHAFT POSITION (CMP) SENSOR | 2
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B193	TURBOCHARGER/SUPERCHARGER (TC/SC) BOOST AIR TEMPERATURE SENSOR
B240	CLUTCH POSITION SENSOR
B302	NEUTRAL POSITION (NP) SENSOR
B311	TURBOCHARGER (TC) WASTEGATE ACTUATOR POSITION SENSOR
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
F	FUSE
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
H149	STOP-START SYSTEM WARNING LAMP
K4-I	STARTER MOTOR RELAY | 1
K4-II	STARTER MOTOR RELAY | 2
K46	ENGINE CONTROL (EC) RELAY
K79	IGNITION MAIN CIRCUITS RELAY
M12	FUEL PUMP (FP)
M89	THROTTLE MOTOR
M158	TURBOCHARGER (TC) INTERCOOLER COOLANT PUMP
P7	TACHOMETER
P9	VEHICLE SPEEDOMETER
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S79	CRUISE CONTROL MASTER SWITCH
S194	STOP-START SYSTEM MASTER SWITCH
S389-I	ENGINE OIL PRESSURE SWITCH | 1
S389-II	ENGINE OIL PRESSURE SWITCH | 2
S479	SPORT MODE SELECTION SWITCH
T1-I	IGNITION COIL | 1
T1-II	IGNITION COIL | 2
T1-III	IGNITION COIL | 3
T1-IV	IGNITION COIL | 4
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | 1
X900-II	FUSEBOX/RELAY PLATE, ENGINE BAY | 2
X901-I	FUSEBOX/RELAY PLATE, FASCIA| 1
X901-II	FUSEBOX/RELAY PLATE, FASCIA | 2
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
Y116	TURBOCHARGER (TC) WASTEGATE ACTUATOR
Y182	CAMSHAFT POSITION (CMP) ACTUATOR, INTAKE
Y183	CAMSHAFT POSITION (CMP) ACTUATOR, EXHAUST
Y229	ENGINE OIL PRESSURE CONTROL VALVE
Y277-I	CYLINDER DEACTIVATION SYSTEM ACTUATOR, EXHAUST | 1
Y277-II	CYLINDER DEACTIVATION SYSTEM ACTUATOR, EXHAUST | 2
Y278-I	CYLINDER DEACTIVATION SYSTEM ACTUATOR, INTAKE | 1
Y278-II	CYLINDER DEACTIVATION SYSTEM ACTUATOR, INTAKE | 2
Z6	CYLINDER-HEAD
Z15	ENGINE BAY, LH SUSPENSION TURRET
Z79	UNDER CENTRE CONSOLE, FRONT
15	IGNITION SWITCH: IGNITION ON
30	BATTERY +
31	BATTERY –

Electronic Diagnostics

FORD FOCUS 1.0 ECOBOOST

Tracing and fixing faults in electronic engine management systems

Strong performance and low fuel consumption are hallmarks of Ford's 1.0 EcoBoost petrol engine. **Kim Henson** and **Edward Haggar** look at its diagnostic issues.

NOTE:
All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

In this feature we are looking specifically at Ford Focus models powered by the three-cylinder 1.0-litre EcoBoost engine, first introduced in 2012. These motors are also used across a wide variety of other Fords. There is also a four-cylinder EcoBoost unit.

The thinking behind the EcoBoost engines is admirable: to optimise power output from a relatively small-capacity engine, while minimising emissions and fuel consumption. The 1.0-litre engine produces 100PS, 125PS or 140PS, depending on the specific application. Exhaust gas-driven turbocharging and direct-injection of petrol into the combustion chambers help to achieve these high power outputs, and variable cam timing provides high torque at low engine speeds.

There's no doubt that these cars are economical and good to drive. Both Fiesta and Focus models with the 1.0-litre engine perform at levels more normally associated with a 1.6-litre vehicle and fuel consumption is frugal.

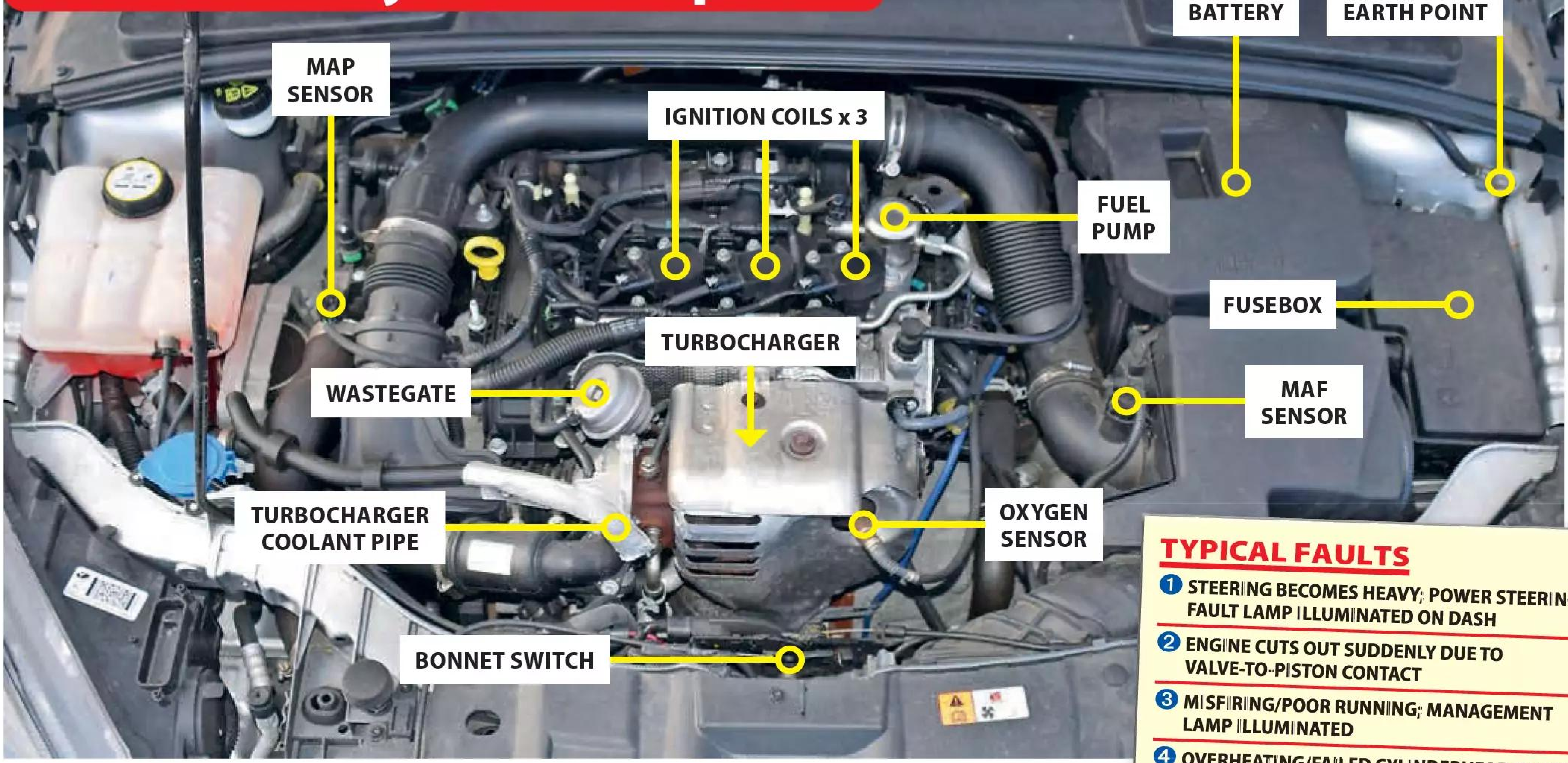
It is also widely known that the failure of a coolant hose on some of these units and overheating of the cylinder-head gasket has led to many wrecked engines. These problems can occur at very low mileages, especially on cars used for long-distance travel.

Initially, many customers were left to pay for their own repairs. However, in 2018, following much adverse publicity, Ford agreed to cover the repair costs at its dealerships. The company also agreed to review previous cases of engine problems, with a view to reimbursing costs already paid. So if you have already been obliged to pay for such repairs, contact your Ford dealer.

In view of these issues, it's essential that regular and diligent maintenance is observed, including using only SAE 5W-20 fully-synthetic oil and the specific coolant recommended by Ford.

Our guide to the diagnostic aspects of this engine – code M1DD – and its Bosch MED17 management system is Edward Haggar.

999cc three-cylinder 12v petrol



TYPICAL FAULTS

1. STEERING BECOMES HEAVY; POWER STEERING FAULT LAMP ILLUMINATED ON DASH
2. ENGINE CUTS OUT SUDDENLY DUE TO VALVE-TO-PISTON CONTACT
3. MISFIRING/POOR RUNNING; MANAGEMENT LAMP ILLUMINATED
4. OVERHEATING/FAILED CYLINDERHEAD GASKET

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is very useful for this Focus. It also works well with other makes and models.

Preparation

With this Focus, frequent and regular servicing is imperative to minimise the possibility of engine problems. If you are unsure of the car's history, carry out a full service regardless, paying special attention to lubrication and coolant.

Fault 1

HEAVY POWER STEERING OPERATION

This first fault applies across the range of EcoBoost engines rather than being confined to the 1.0 unit. When driving normally, the steering can suddenly become heavy in operation and the wheel is difficult to turn, accompanied by illumination of the power steering warning lamp on the dash.

The first check should be the battery and charging system. The power steering is controlled by electric motors, ECUs, etc, which rely on receiving the correct battery voltage. If the power system is working fine, carry out a full diagnostic scan, which may throw up the permanent fault code 'U3000', relating to internal failure in the steering ECU.

The motor/control module is located between the steering column and the rack and is fixable using the services of any good ECU repair company. If you want to fit a new unit, coding by either a main dealer or specialist will be required.

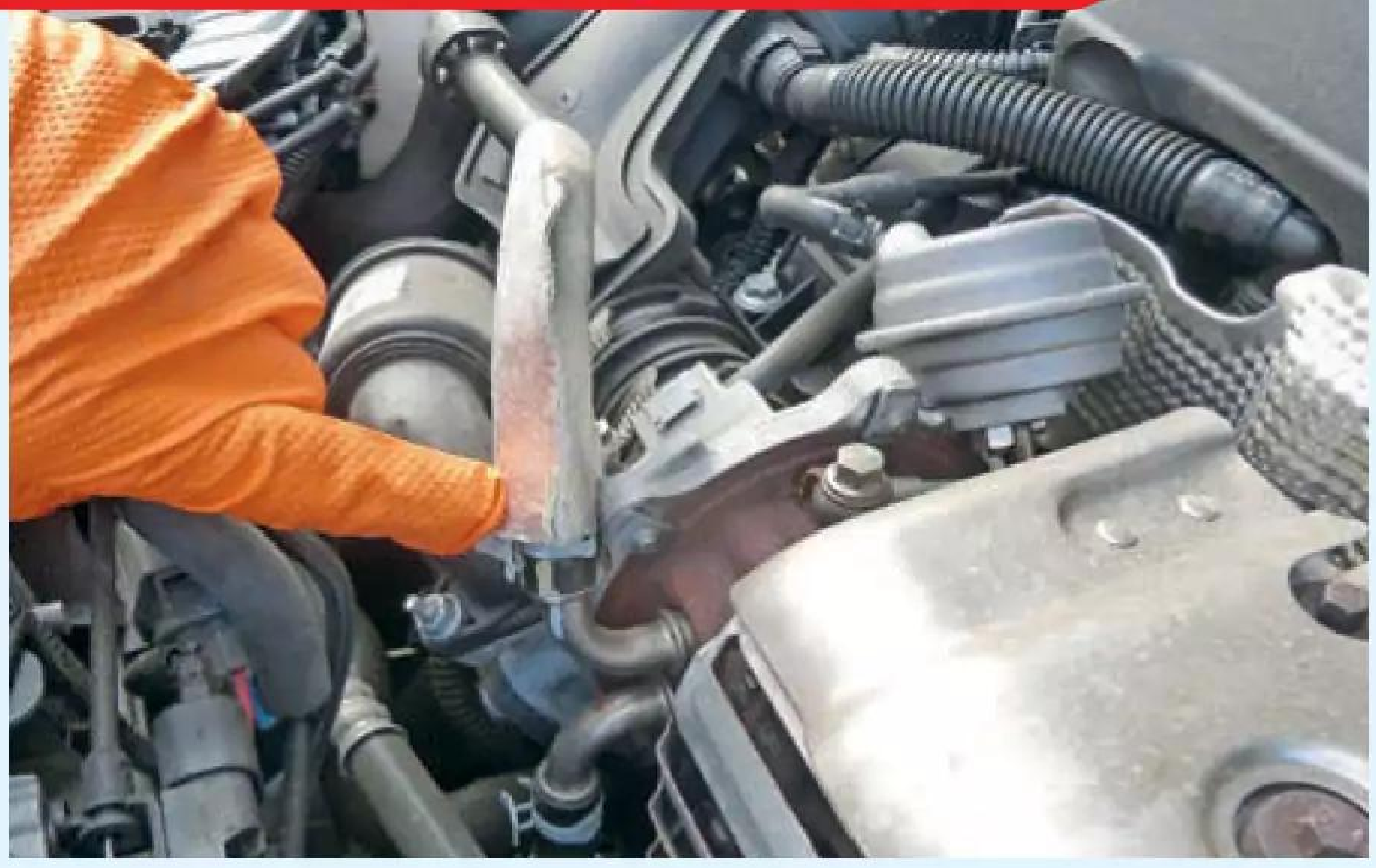
Fault 2

ENGINE DAMAGE CAUSED BY USING INCORRECT OIL

For these engines it is essential to use the specified 5W-20 fully-synthetic oil and you are advised against using cheaper oil. On the 1.0 EcoBoost engine, Ford incorprate a 'wet belt' system, where the cambelt runs in engine oil and is sealed in the unit. If you use oil of the wrong grade or viscosity then the belt won't be getting properly lubricated.

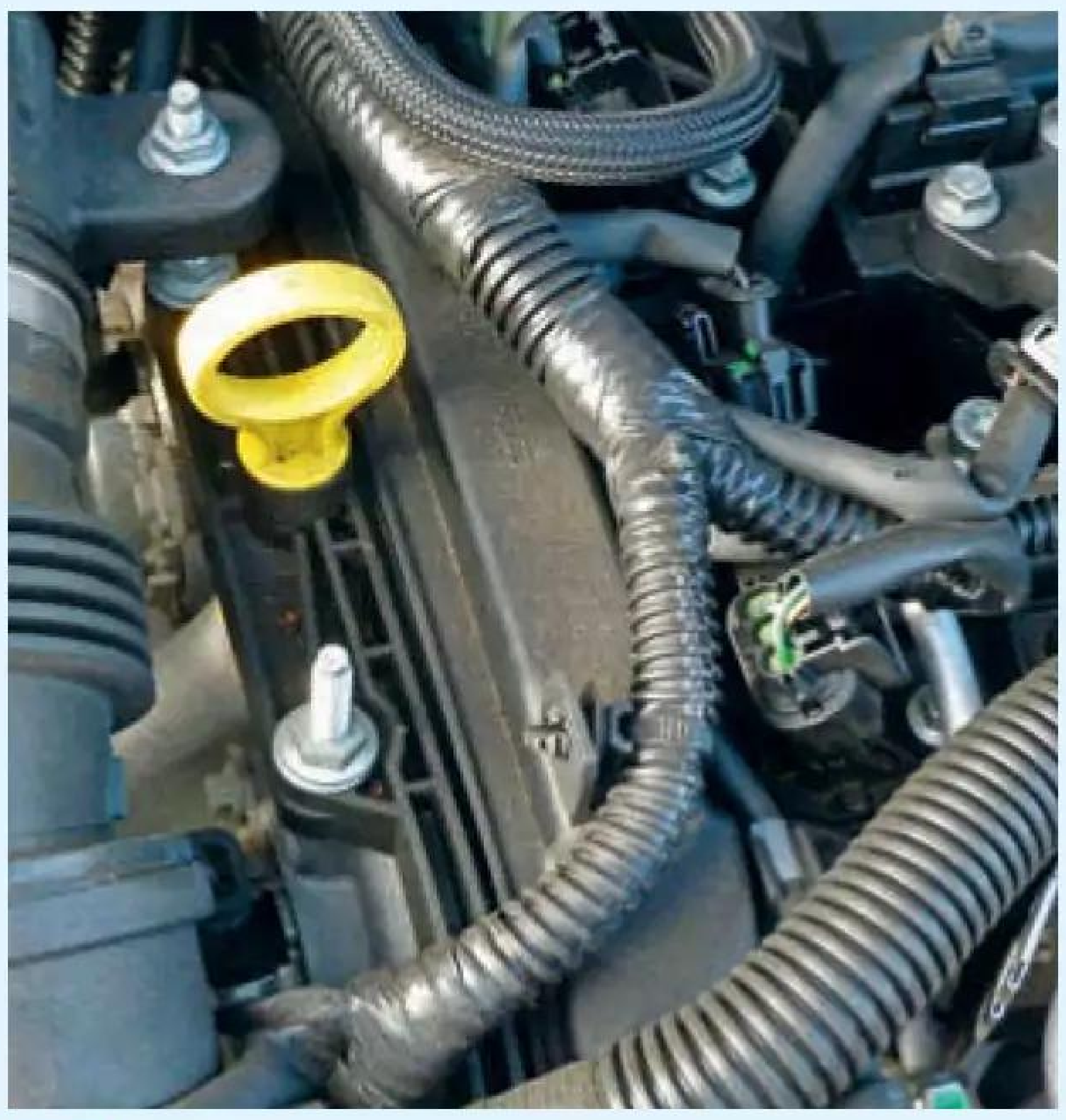
If this happens, the engine will simply cut out, with disastrous consequences. The belt slips and moves via the drive teeth, allowing the valve timing to shift, resulting in an expensive coming together of the pistons and valves.

Typical Ford Focus components

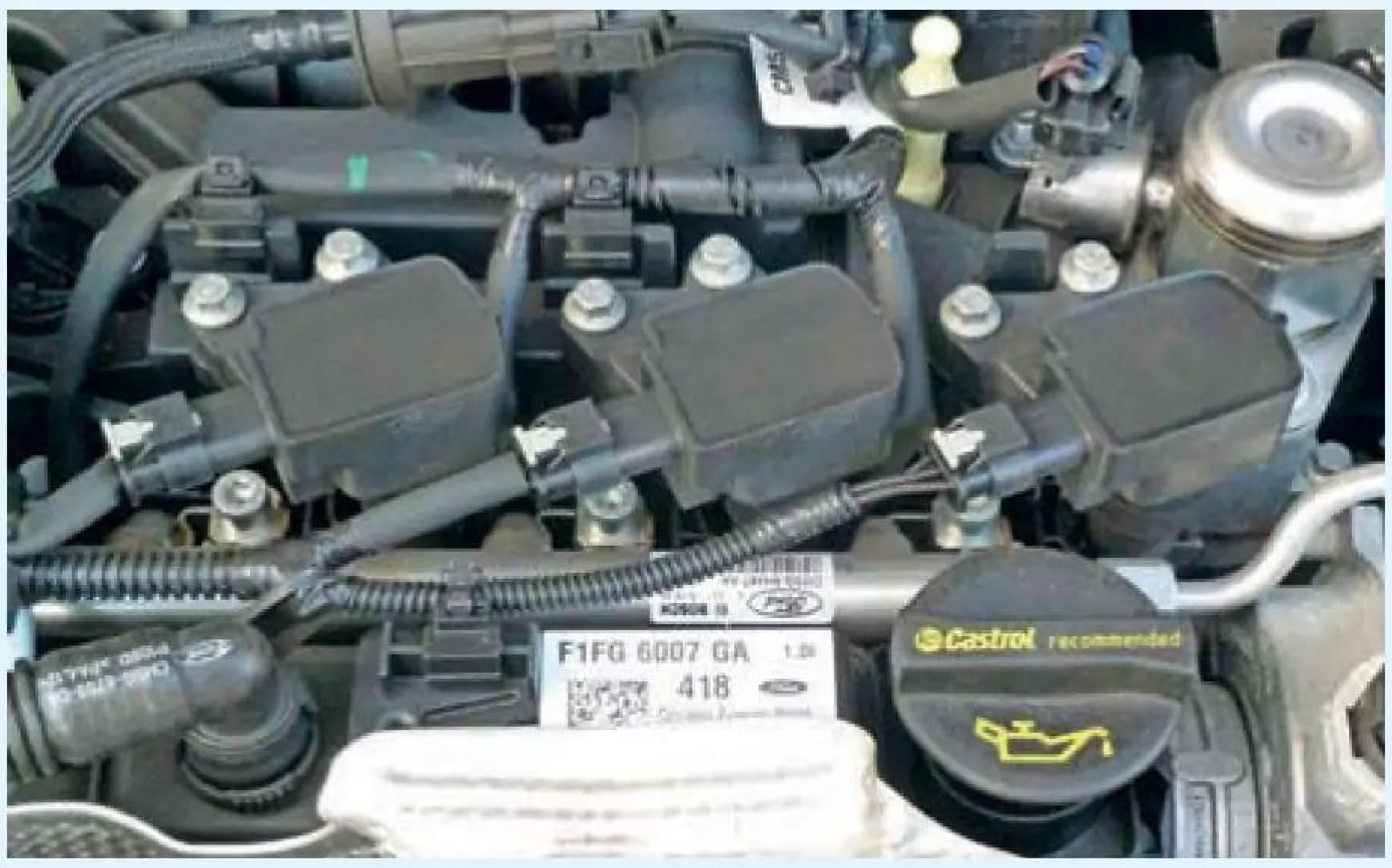


1 ▶ **This coolant feed pipe connected to the turbocharger is potentially a problem area on these engines. Early cars were fitted with a plastic type that was prone to breaking, resulting in a 'cooked' motor. Later examples have a more flexible and durable rubber hose.**

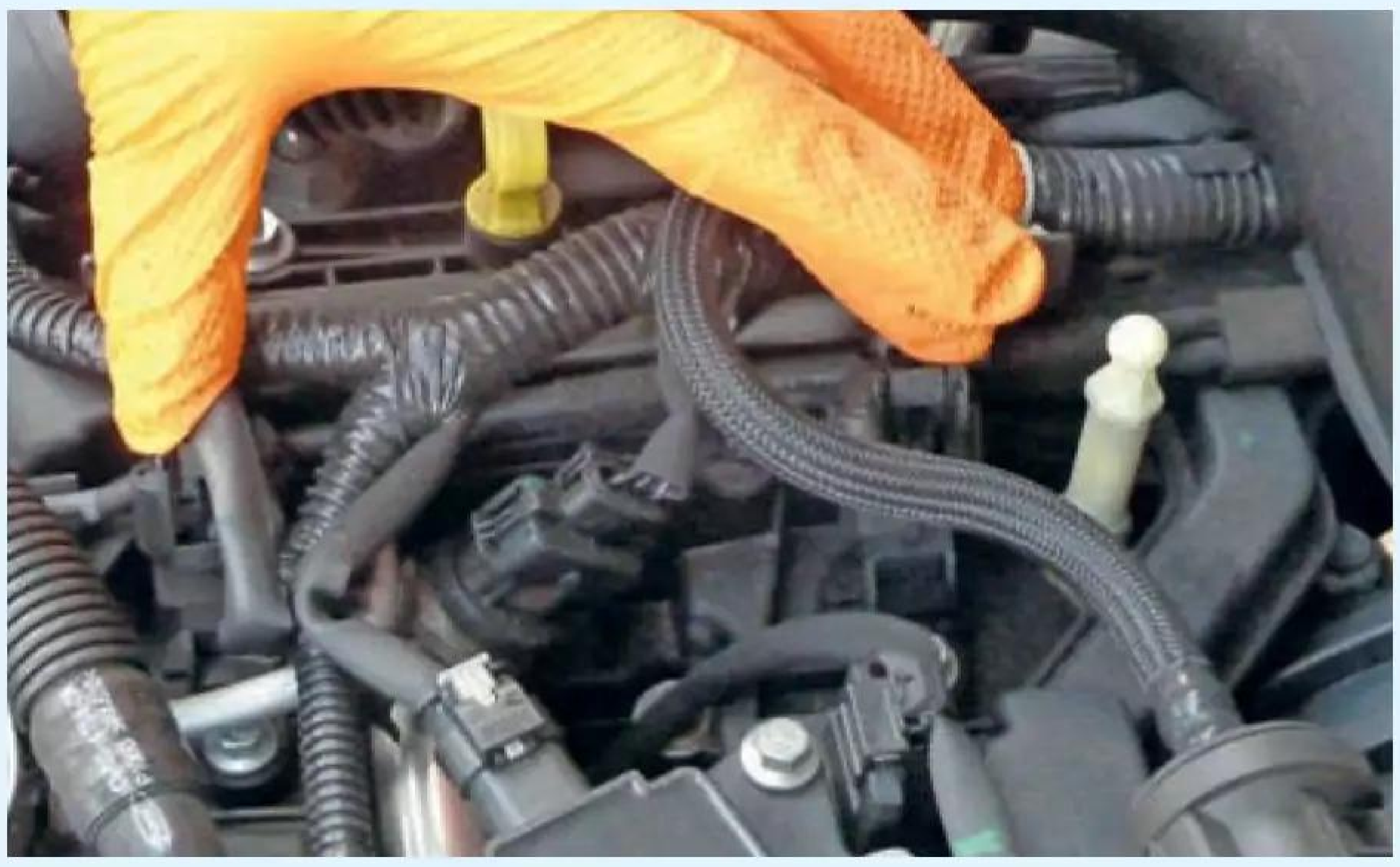
2 **The turbocharger is vital in helping EcoBoost engines deliver high levels of power and torque, while minimising emissions and fuel consumption. The turbo is generally reliable, provided frequent engine oil changes are carried out.**



3 **Hidden beneath the plastic cover to the right of the dipstick is the 'wet' timing belt that runs in engine oil. It is critical that the correct viscosity of engine oil is used – if it's too thick, the belt can break.**



4 ◀ **The three pencil-type ignition coils are bolted in place and are readily accessible once the engine's top cover is removed. Look for blistering on the coils, indicating failure, following which misfiring will occur. With only three cylinders, the car will be left virtually undriveable.**



5 ▶ **There are position sensors serving the inlet camshaft – towards the front of the engine and to the left of this photograph – and the exhaust camshaft is towards the rear of the motor and beneath the middle finger in this photo.**

ENGINE MANAGEMENT

The Bosch MED17 management system used on this Focus incorporates these primary components:

- 3 x solenoid-type fuel injectors
- 3 x pencil-type ignition coils
- Inlet and exhaust camshaft position actuators
- Mass air flow sensor built into the air filter trunking
- Smart-charge charging system
- Coolant temperature sensor mounted in housing on side of cylinderhead
- Knock sensor located in engine block
- Digital crank and cam sensor
- Pre- and post-catalytic converter oxygen sensors
- Main fuel pump mounted on end of the cylinderhead
- Keyless starting and entry via smart key

The belt interval on the Ford Focus 1.0 EcoBoost is 150,000 miles or 120 months. In one case we are aware of, the car had failed at 67,000 miles. It transpired that the owner had left it to his mechanic to change the oil, thus couldn't confirm either the grade or quality used. We suspect the wrong oil had been used – it was even possible that the oil hadn't been changed at all.

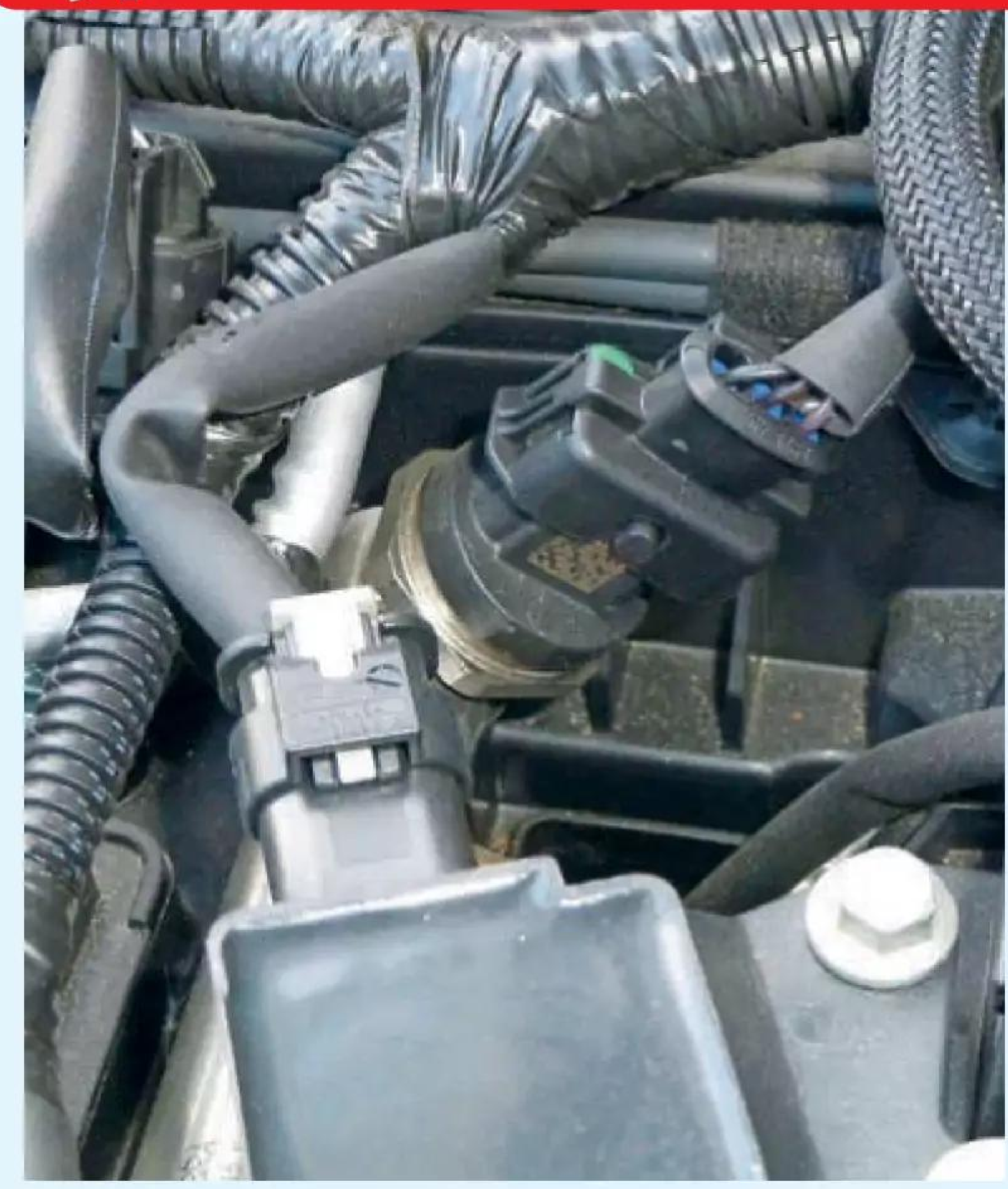
Replacing the timing belt change on these engines isn't advisable for anyone who isn't sure of the work involved. Autodata gives a seven-hour job time, but it can take up to a day if you're doing it for the first time. Do not be tempted to carry out the job without the correct locking tools – the crank is not keyed and incorrect alignment by even a few millimetres can have serious consequences.

Fault 3

FAILED IGNITION COILS

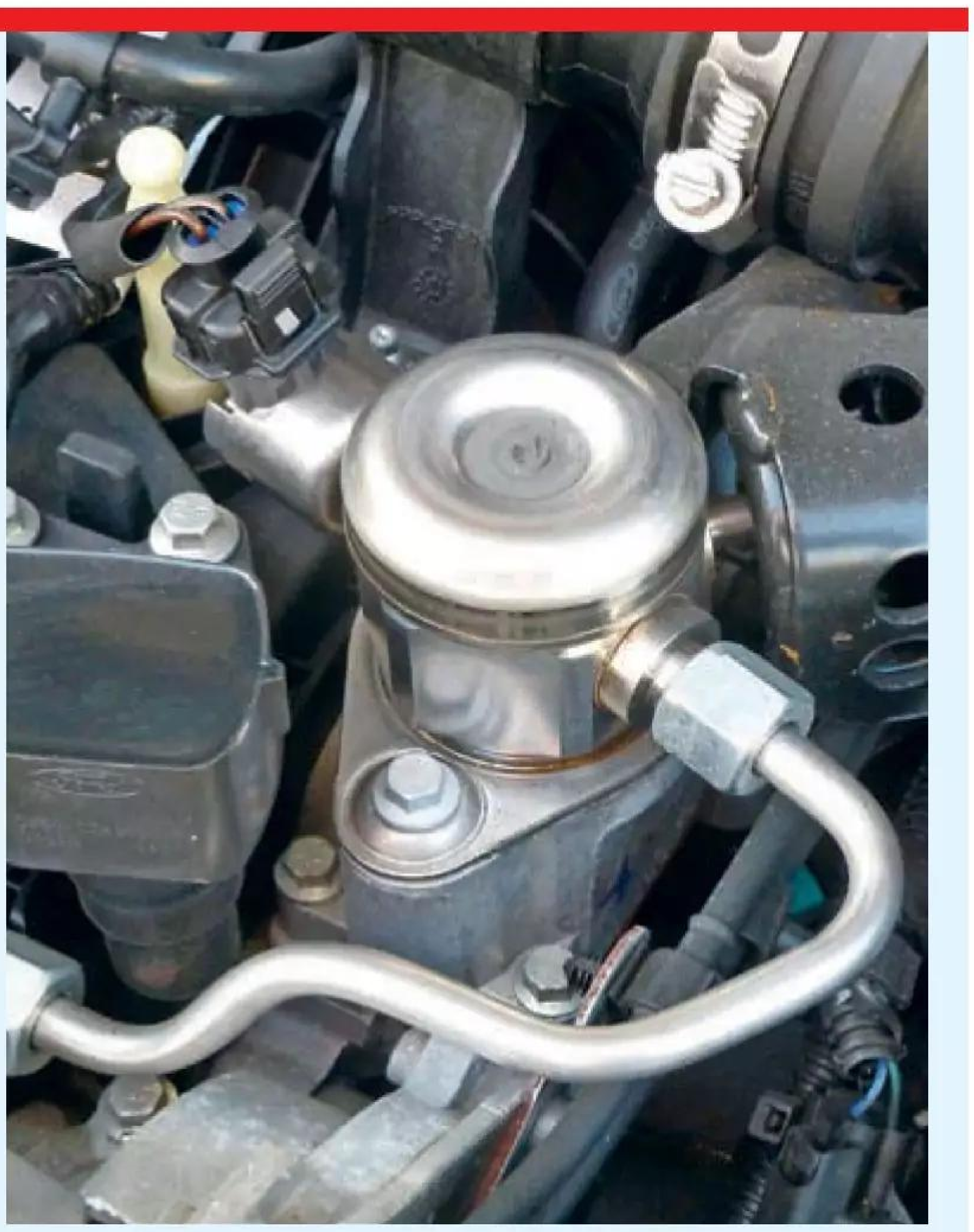
If the engine is running badly or misfiring and the engine management lamp is illuminated, the fault may lie with a failed coil pack. As you can imagine, a three-cylinder engine running on two cylinders will be pretty much undriveable.

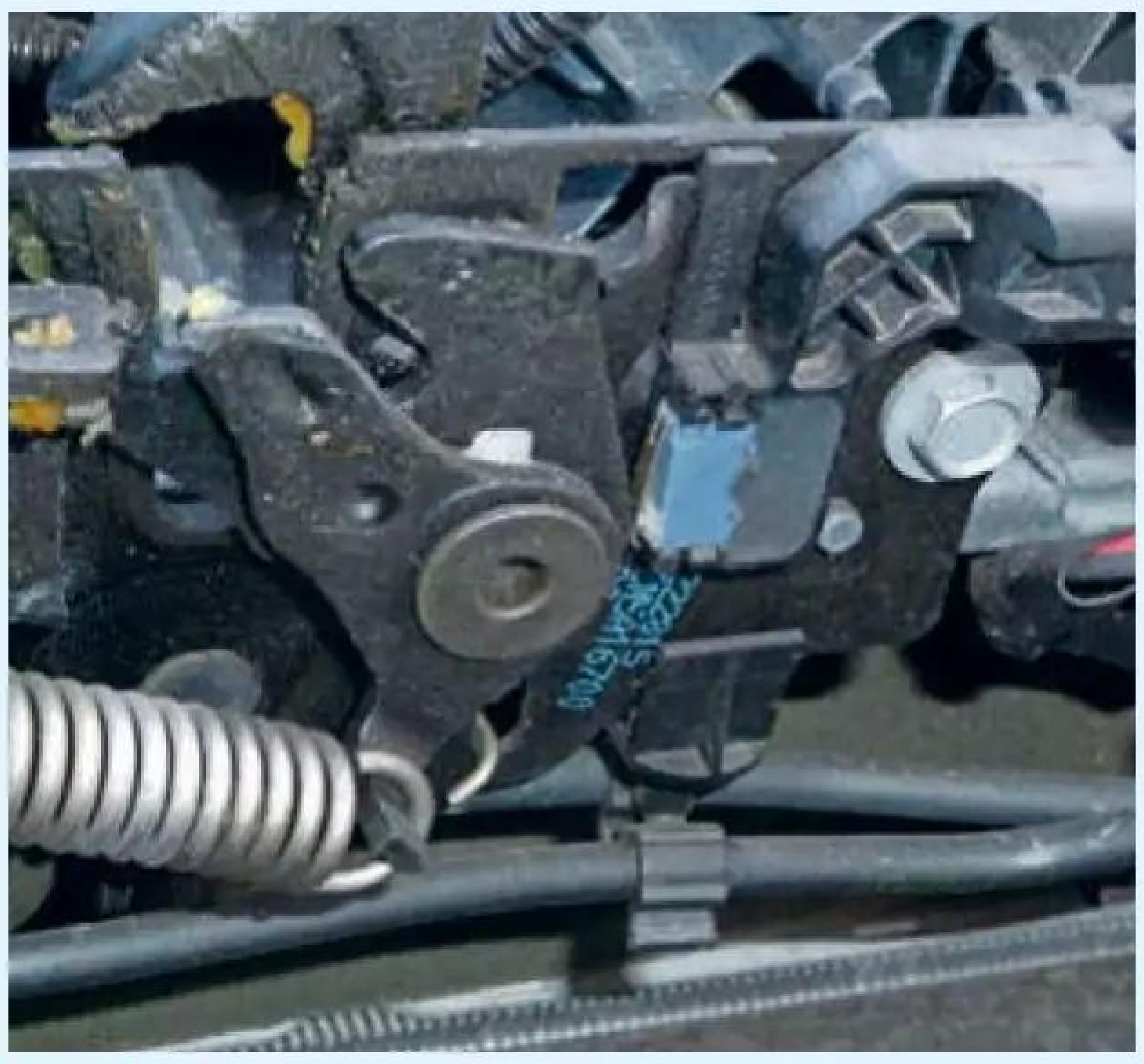
Typical Ford Focus components



6 ◀ **The fuel pressure sensor, visible in the centre of this photo, is mounted at the right-hand end of the fuel rail. The sensor signals the fuel pressure present within the rail to the ECU, enabling the ECU to optimise fuel delivery.**

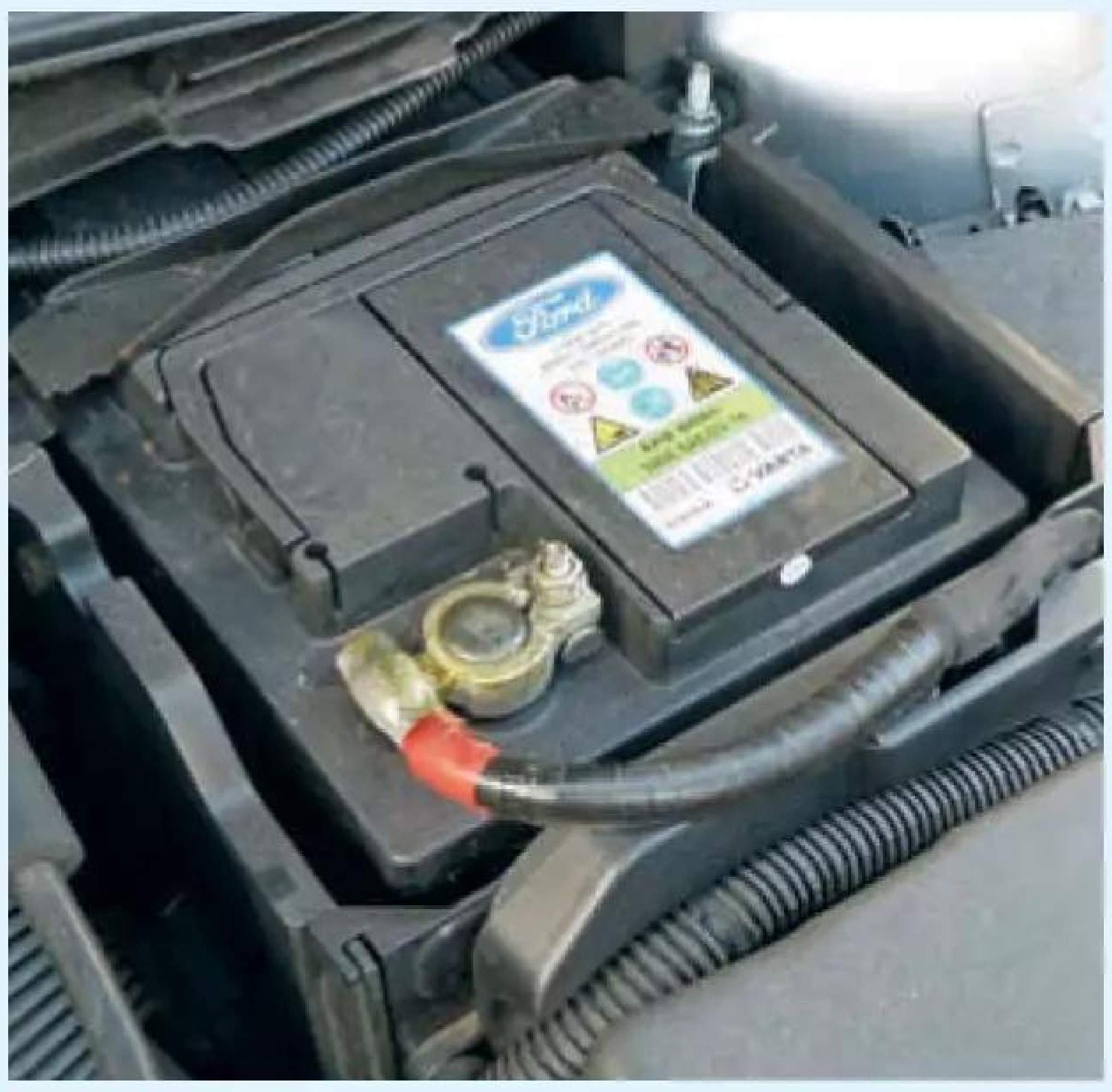
7 ▶ **The high-pressure petrol pump is located towards the top and rear of the engine compartment, on the left-hand side. Check its pipework is sound and isn't worn. Any sign of fuel leakage needs to be dealt with quickly. There is no external fuel filter; the only element is on the fuel tank pump. This filter isn't a changeable component and, in the event of a problem, a complete pump will be required.**



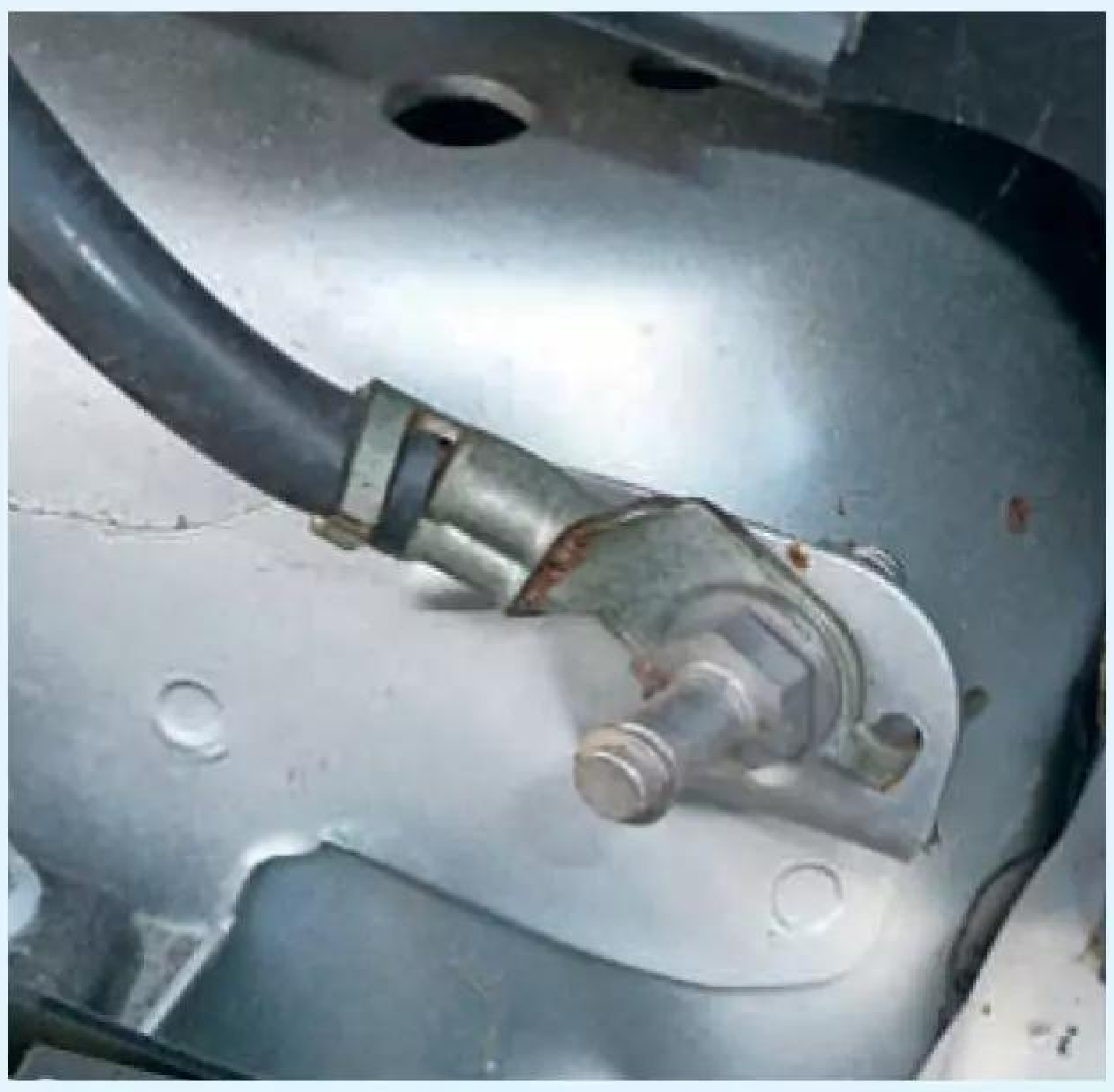


8 **The bonnet latch assembly on the car's front panel might be considered an insignificant or innocuous component. However, if the sensor here detects that the bonnet isn't fully shut, the engine won't crank. Lubricate moving parts sparingly.**

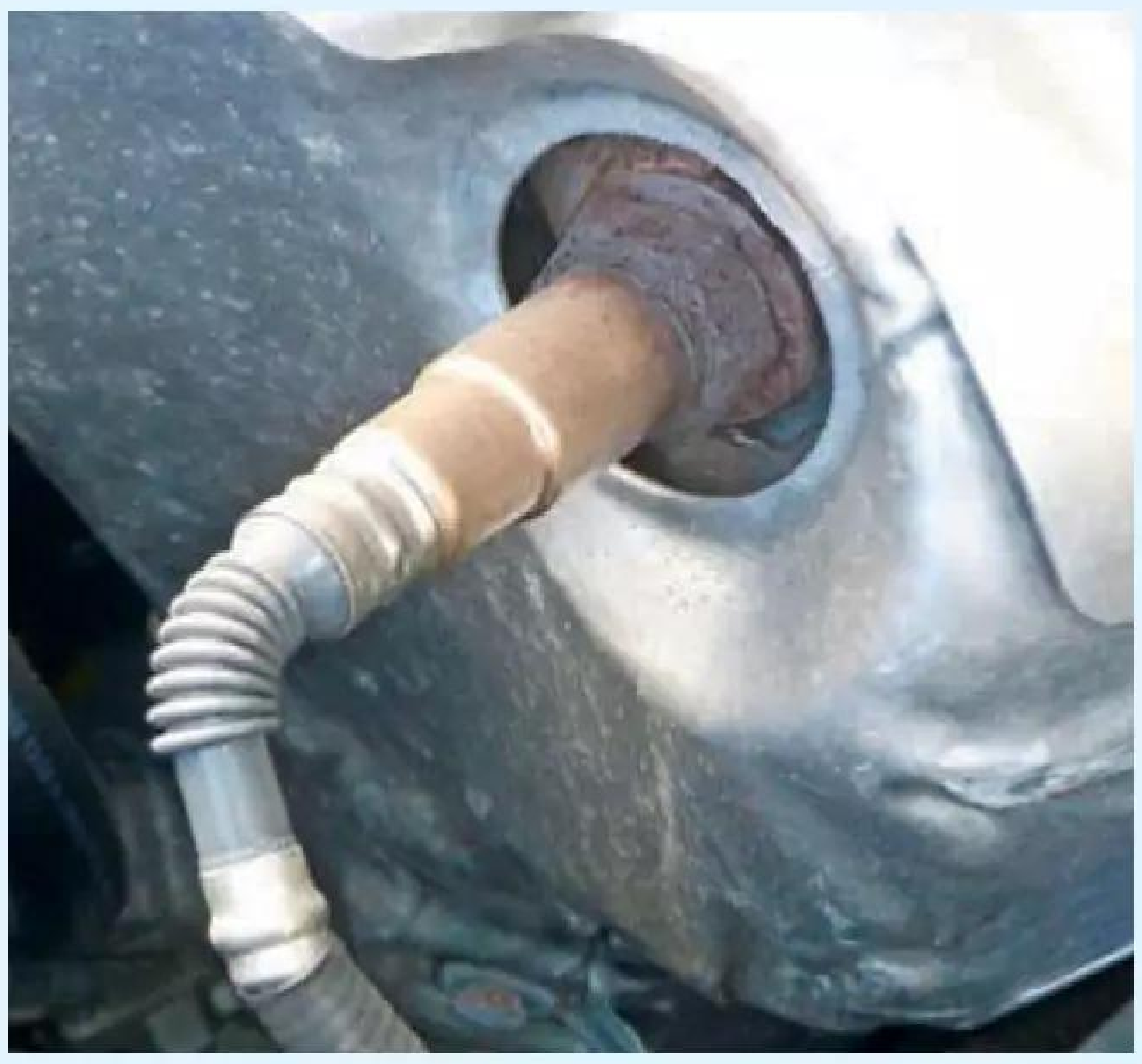
9 **Located within the intake trunking is the air mass sensor. Its job is to assess the rate of air flowing through the system. It delivers this information to the ECU, which then adjusts fuelling levels.**



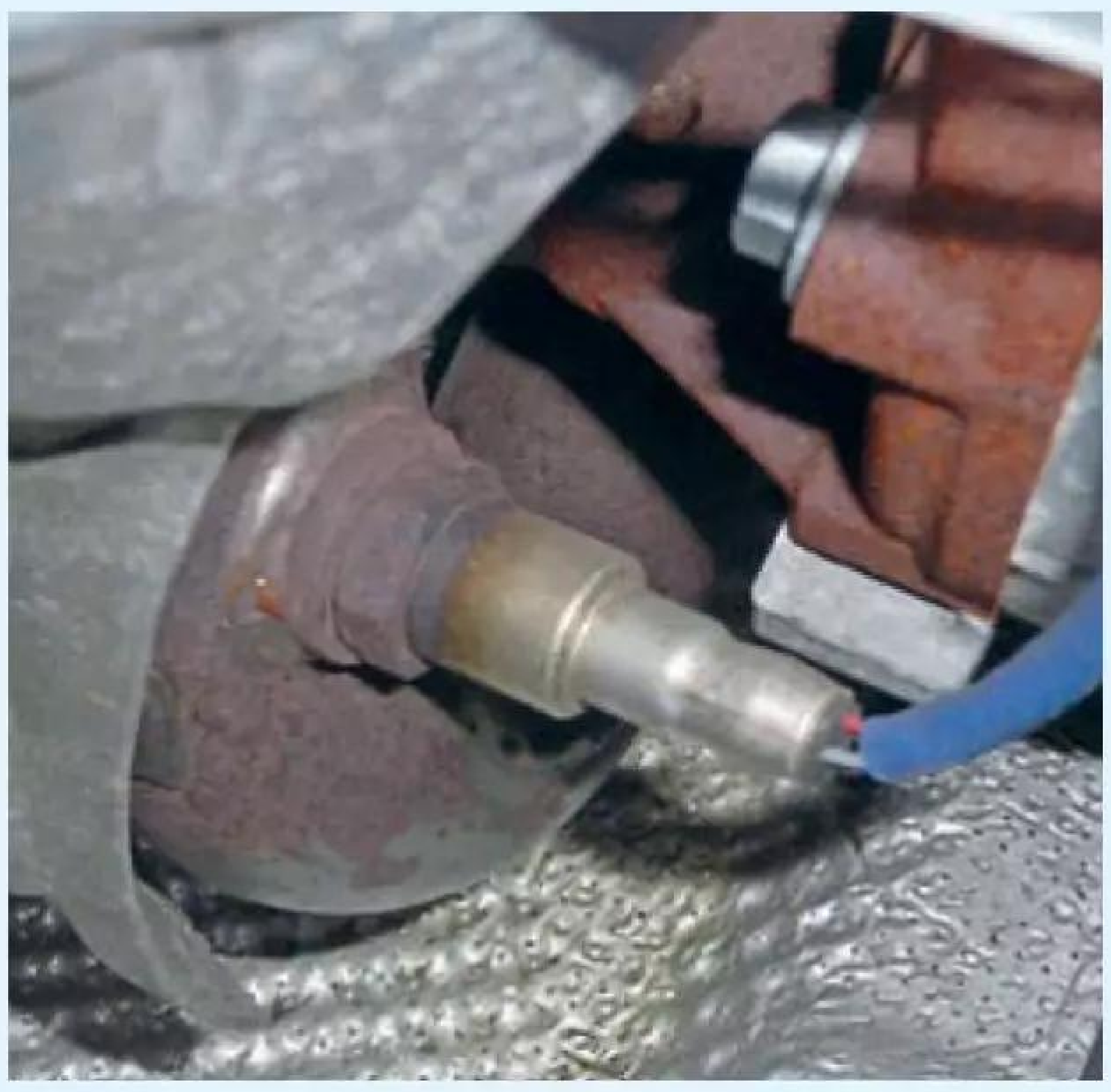
10 **This Focus requires an enhanced flooded battery. It is essential to use only the specified type of battery. Whenever the battery is replaced it is necessary to reprogramme the car to the new battery.**



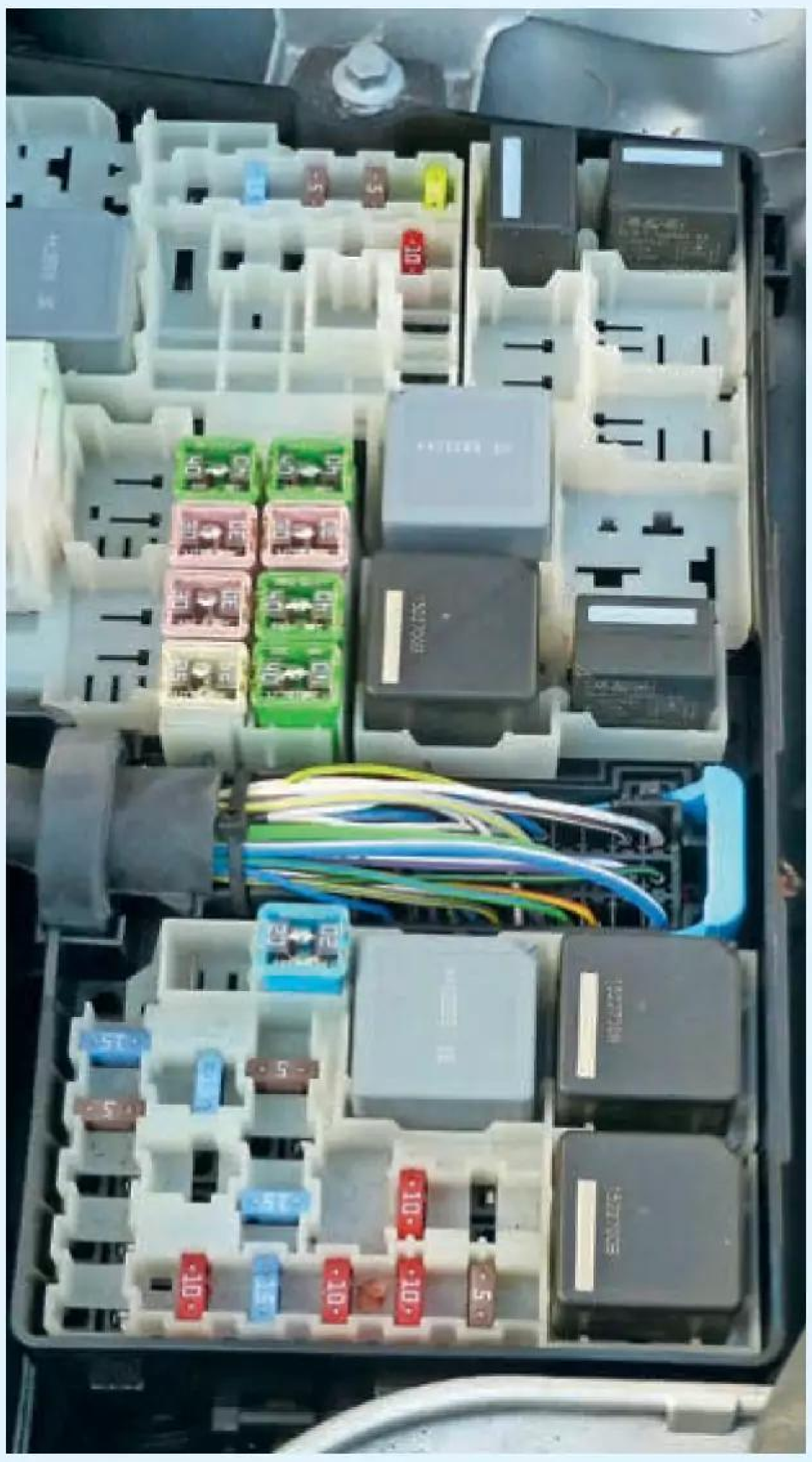
11 If the vehicle needs to be jump-started, use the negative (earth) jump-start connection point on the left-hand front suspension tower, rather than connecting the leads direct to the battery.



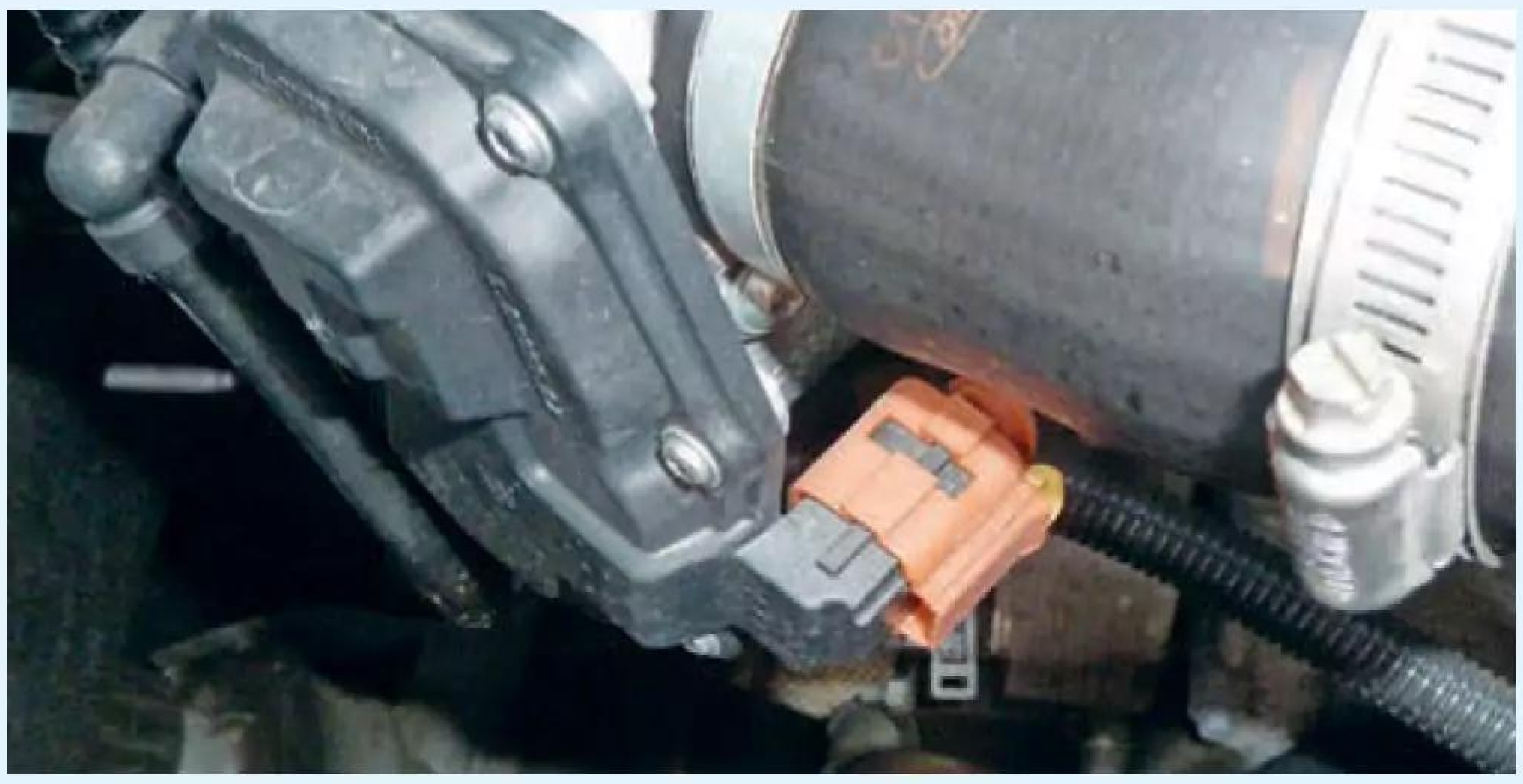
12 The pre-cat Lambda/oxygen/O2 sensor (wideband type) is easy to reach at the front and top of the engine bay. Check the condition and security of the sensor and its connecting cables.



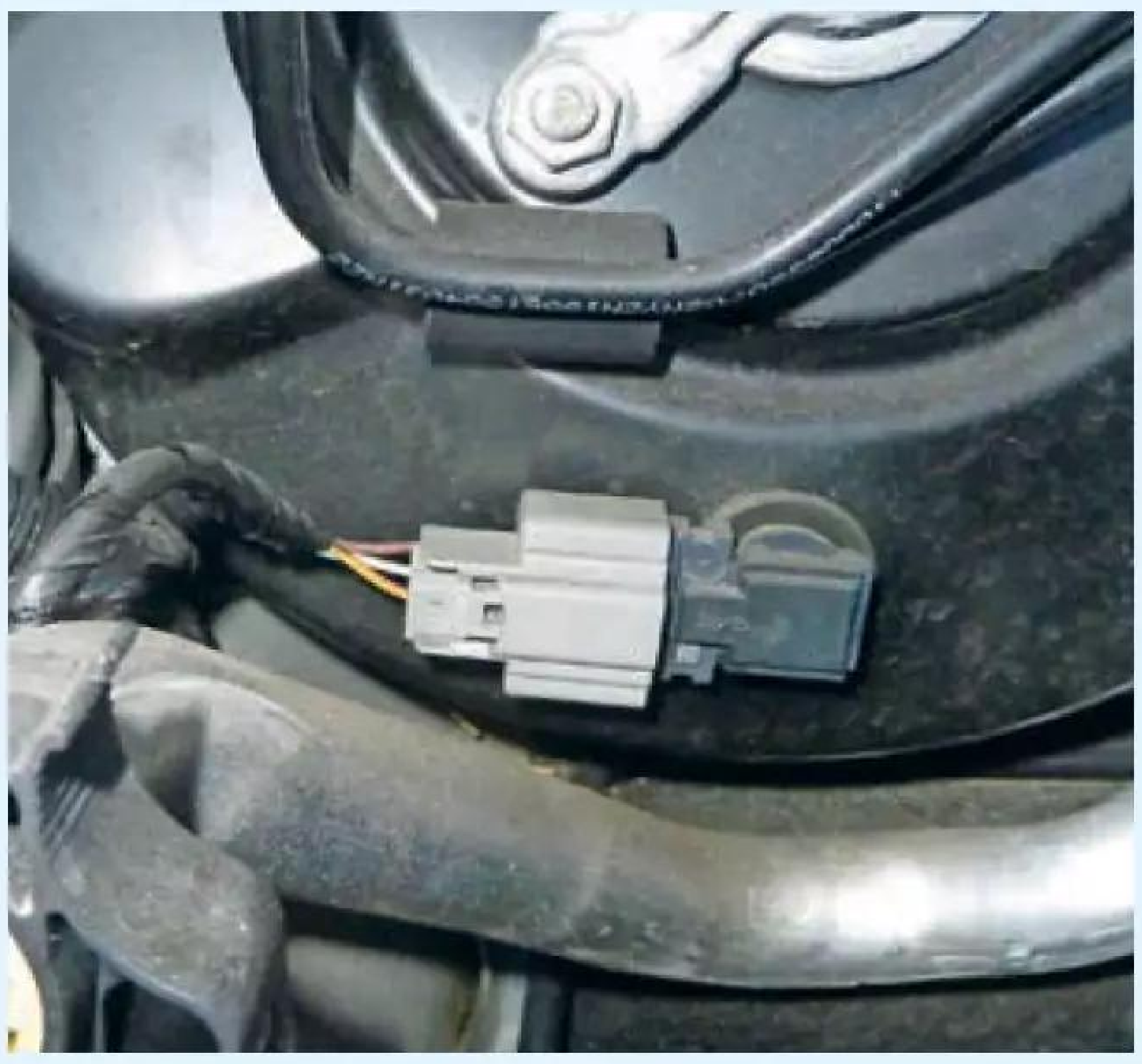
13 The post-cat Lambda/oxygen/O2 sensor is positioned low down within the engine compartment. This sensor relays fuel/air efficiency to the ECU, so that it can minimise emissions and fuel consumption.



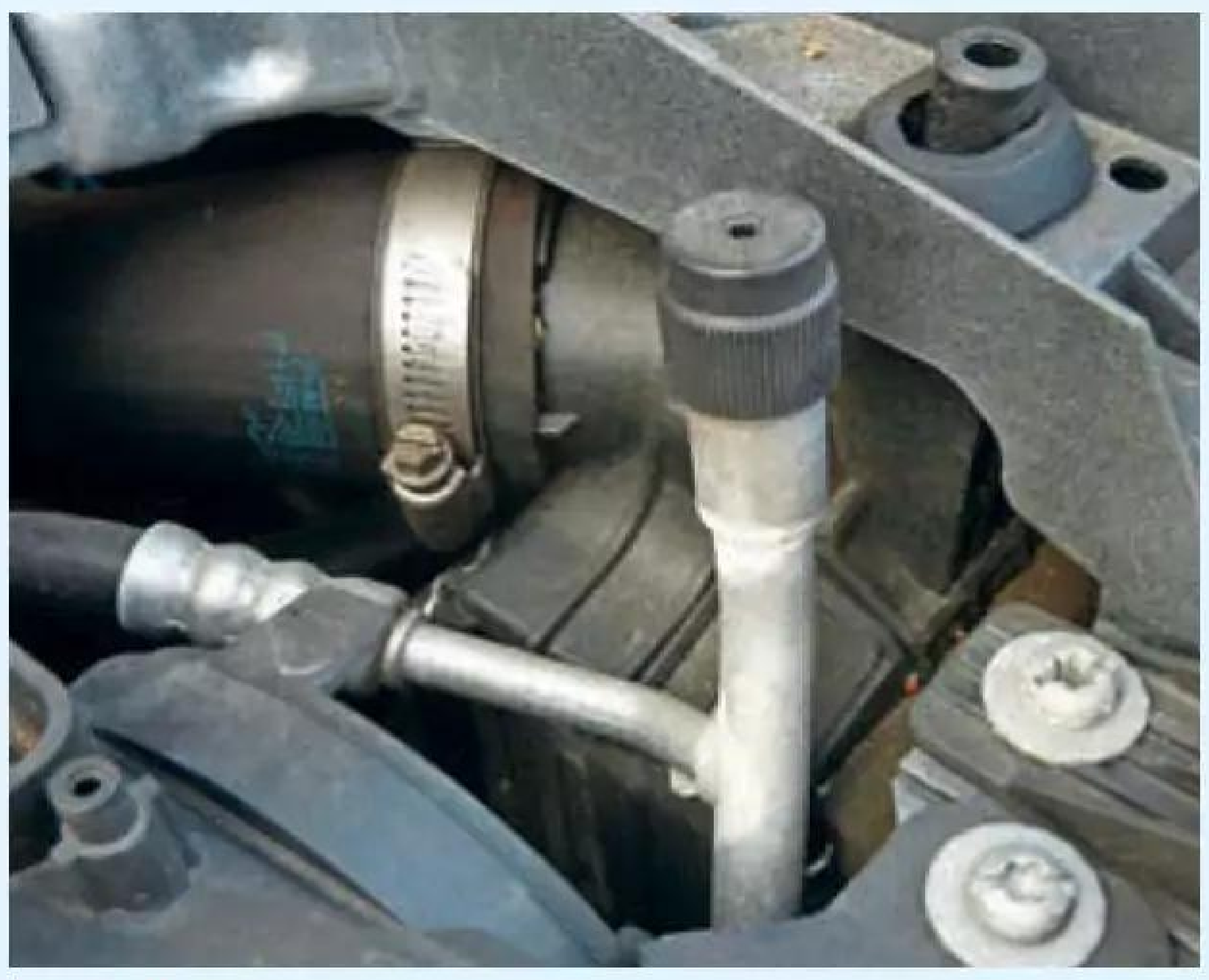
14 The underbonnet fuse/relay box is located immediately adjacent to the left-hand front suspension tower. It is shown here with its lid removed.



15 ◀ This Focus employs a drive-by-wire throttle body assembly. Check and clean the internal components as part of your servicing programme. Note the yellow anti-tamper clip on the orange plug assembly.



16 Visible in the centre of this photograph is the brake pressure sensor, which is mounted on the brake system's servo unit.



17 The high-pressure recharge point for the air-conditioning system, found on the right-hand side of the bonnet catch. Note that the system takes 530 grammes of refrigerant gas (R134a) and uses PAG 46 oil to lubricate the compressor.

As with most coil pack failures, you can simply switch coils to different cylinders to see if the misfire moves, or else use an oscilloscope to confirm current draw. You should also check the spark plugs for signs of excessive wear – when they are worn, they place more strain on the coil and cause it to burn out more quickly.

We recommend changing all of the spark plugs at the same time as the failed coil and to renew all the coils at the same time, to help prevent future problems. As always, fit genuine or good-quality items to original equipment standards.

Be wary of buying such items online unless they are from a reputable seller. We have come across a coil which had been bought on the internet by a Ford owner and although it was supplied in an 'OE' box, it was actually a cheap counterfeit.

Fault 4

TURBOCHARGER COOLANT PIPE

With vehicles dating from 2011-2013, there are known problems with the coolant feed pipe connected to the turbocharger. The vehicle shown here is a later example and doesn't fall within the problem timescale, nevertheless these engines require the cooling system to be in A1 condition, including all the cooling pipes.

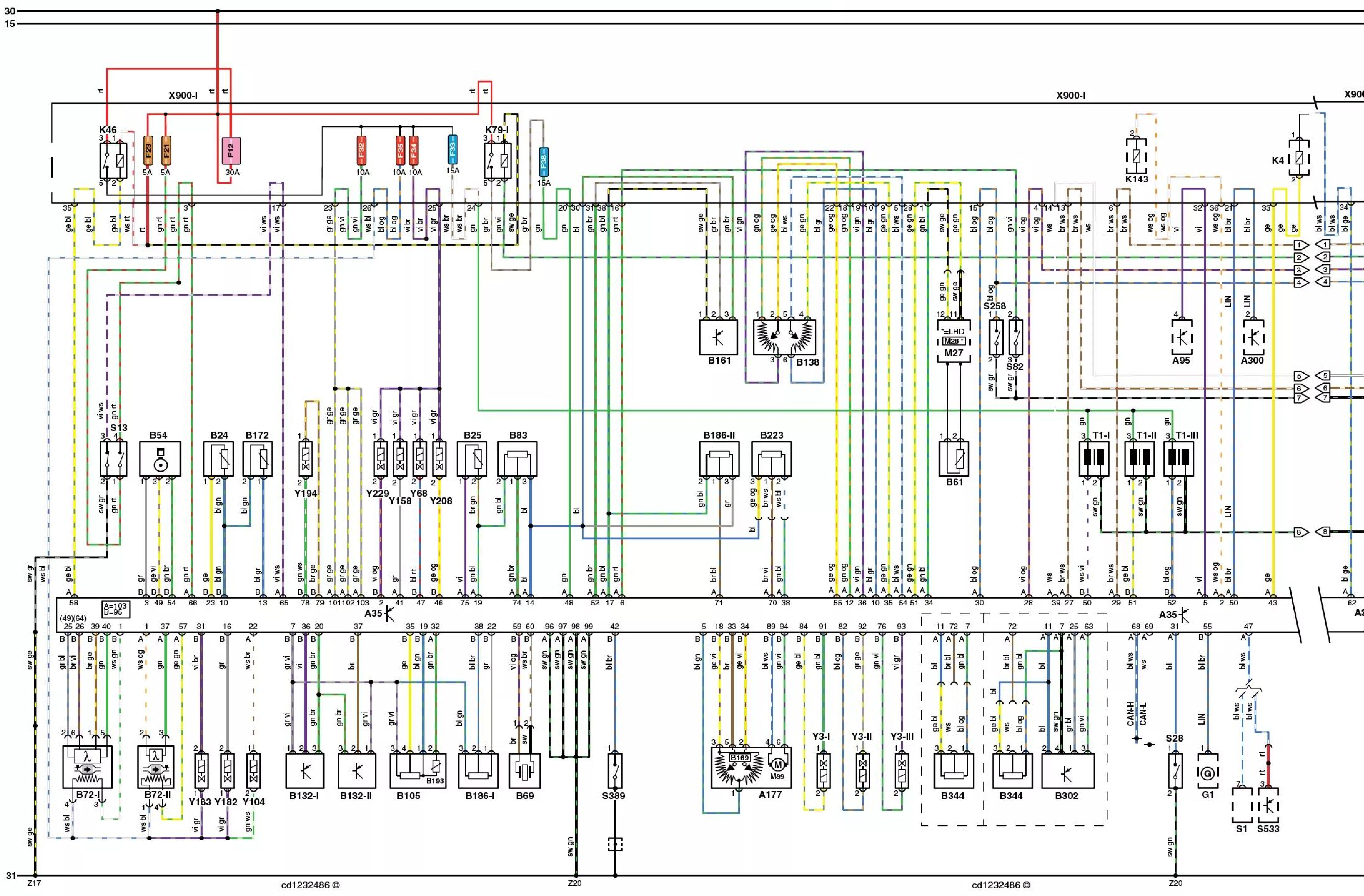
The plastic pipework needs to be inspected on a frequent, regular basis, and even the tiniest faults must be rectified quickly.

This EcoBoost engine doesn't like to overheat and you risk blowing a head gasket if gets too warm.

⇨

BOSCH MED17 CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
31
X900-I
K46
F23 5A
F21 5A
F12 30A
F32 10A
F35 10A
F34 10A
F33 15A
K79-I
F36 15A
K143
K4
S258
B161
B138
M27
=LHD
S82
A95
A300
LIN
S13
B54
B24
B172
Y194
Y229
Y158
Y68
Y208
B25
B83
B186-II
B223
B61
T1-I
T1-II
T1-III
A35
A=103
B=95
B72-I
B72-II
Y183
Y182
Y104
B132-I
B132-II
B105
B193
B186-I
B69
S389
B169
M89
A177
Y3-I
Y3-II
Y3-III
B344
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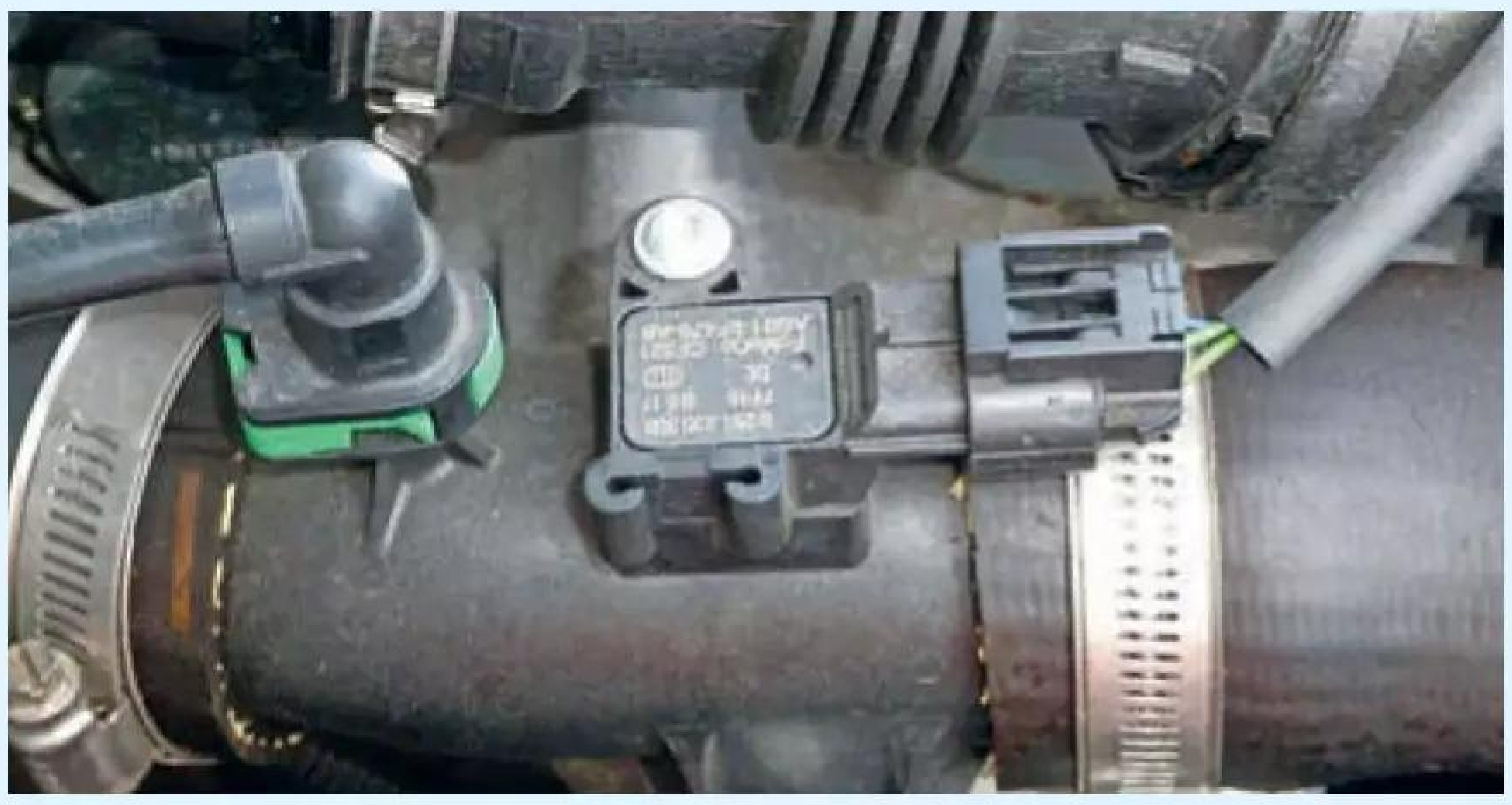


18 ◀ The manifold absolute pressure (MAP) sensor – centrally positioned in this shot – is found at the right-hand end of the engine. This sensor monitors the pressure within the inlet manifold, helping the ECU to determine correct fuelling levels.

19 The diagnostic socket on this Ford is found on the right-hand side of the fascia and is normally concealed by a drop-down hinged plastic cover.

20 Here, the diagnostic socket is shown with the SOLUS Edge connection cable plugged in, to enable diagnostic interrogation to be carried out.

USEFUL DATA

These are th
change inte
component
recommen

Service interval Every 12,500 miles or 12 mont

Cambelt Every 150,000 miles or 120 months

Air filter Every 37,500 miles or 36 months, whic

Spark plugs Every 37,500 miles or 36 months

Engine oil Every 12,500 miles or 12 months, wh

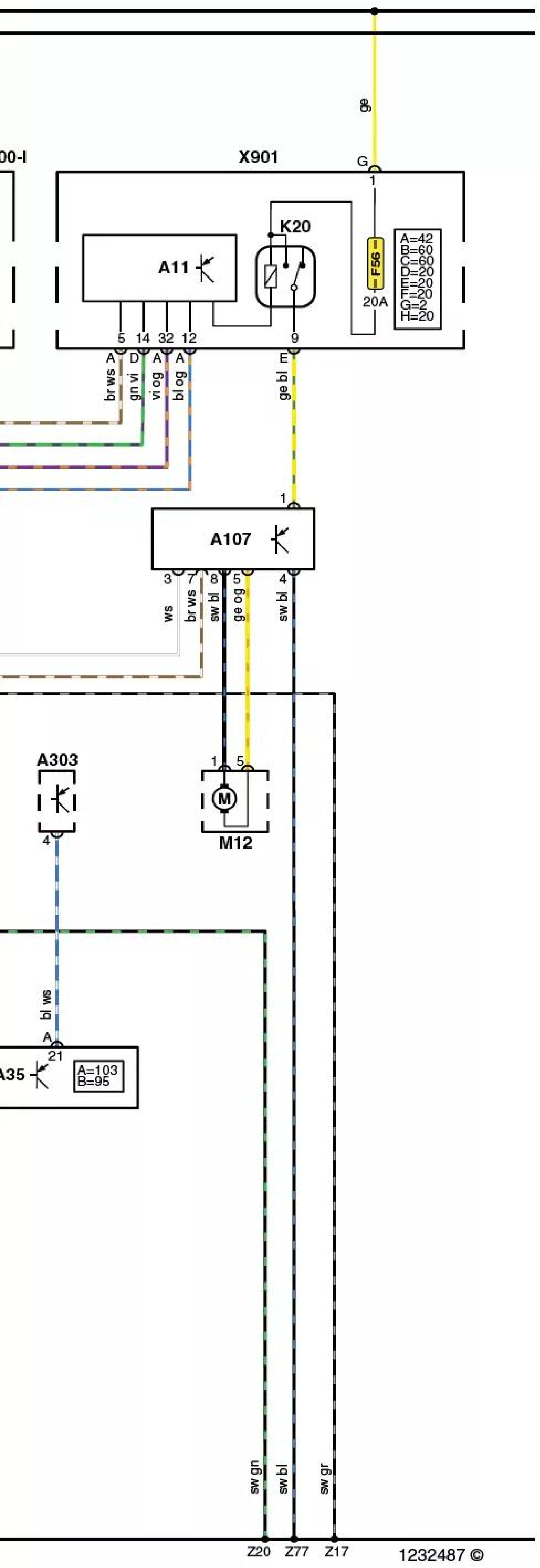
Oil type SAE 5W-20 fully-synthetic **Capacity** (s

Brake fluid Every two years

Technical Specs

Actual values

Component	Value
Fuel main pump delivery pressure	40-150 Bar
Injector	1.2 ohms
Oxygen sensor heater circuit	3 ohms
Turbo wastegate regulating valve	16 ohms
Camshaft position actuator	7 ohms



CODE	COMPONENT DESCRIPTION
A11	MULTIFUNCTION CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A107	FUEL PUMP CONTROL MODULE
A177	THROTTLE CONTROL UNIT
A300	ENGINE COOLANT RADIATOR FLAP CONTROL MODULE
A303	DC/DC CONVERTER CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B61	OUTSIDE AIR TEMPERATURE SENSOR
B69	KNOCK SENSOR (KS)
B72-I	HEATED OXYGEN SENSOR (HO2S) | **1**
B72-II	HEATED OXYGEN SENSOR (HO2S) | **2**
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132-I	CAMSHAFT POSITION (CMP) SENSOR | **1**
B132-II	CAMSHAFT POSITION (CMP) SENSOR | **2**
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
B172	CYLINDER HEAD TEMPERATURE (CHT) SENSOR
B186-I	FUEL RAIL PRESSURE (FRP) SENSOR | **1**
B186-II	FUEL RAIL PRESSURE (FRP) SENSOR | **2**
B193	TURBOCHARGER/SUPERCHARGER (TC/SC) BOOST AIR TEMPERATURE SENSOR
B223	BRAKE SYSTEM VACUUM SENSOR
B302	NEUTRAL POSITION (NP) SENSOR
B344	CLUTCH MASTER CYLINDER POSITION SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
F	FUSE
G1	ALTERNATOR
K4	STARTER MOTOR RELAY
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY

CODE	COMPONENT DESCRIPTION
K79-I	IGNITION MAIN CIRCUITS RELAY | **1**
K143	AC COMPRESSOR CLUTCH RELAY
LIN	LOCAL INTERCONNECT NETWORK (DATA BUS)
M12	FUEL PUMP (FP)
M27	DOOR MIRROR ADJUSTMENT MOTOR, DRIVER
M28	DOOR MIRROR ADJUSTMENT MOTOR, PASSENGER
M89	THROTTLE MOTOR
S1	IGNITION SWITCH
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S28	REVERSE GEAR POSITION SWITCH
S82	CRUISE CONTROL CLUTCH PEDAL SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S389	ENGINE OIL PRESSURE SWITCH
S533	START/STOP BUTTON
T1-I	IGNITION COIL | **1**
T1-II	IGNITION COIL | **2**
T1-III	IGNITION COIL | **3**
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | **1**
X901	FUSEBOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y68	TURBOCHARGER (TC) WASTEGATE REGULATING VALVE
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
Y158	AC COMPRESSOR CAPACITY CONTROL SOLENOID
Y182	CAMSHAFT POSITION (CMP) ACTUATOR, INTAKE
Y183	CAMSHAFT POSITION (CMP) ACTUATOR, EXHAUST
Y194	FUEL FLOW CONTROL VALVE
Y208	EXHAUST GAS RECIRCULATION (EGR) COOLER BYPASS VALVE
Y229	ENGINE OIL PRESSURE CONTROL VALVE
Z17	ENGINE BAY, BEHIND LH HEADLAMP
Z20	ENGINE BAY, LH CHASSIS LEG
Z77	UNDER REAR SEAT, RH
15	IGNITION SWITCH – IGNITION ON
30	BATTERY +
31	BATTERY –

he official recommended ervals for the various ts. However, we d these are at least halved.

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chever comes first

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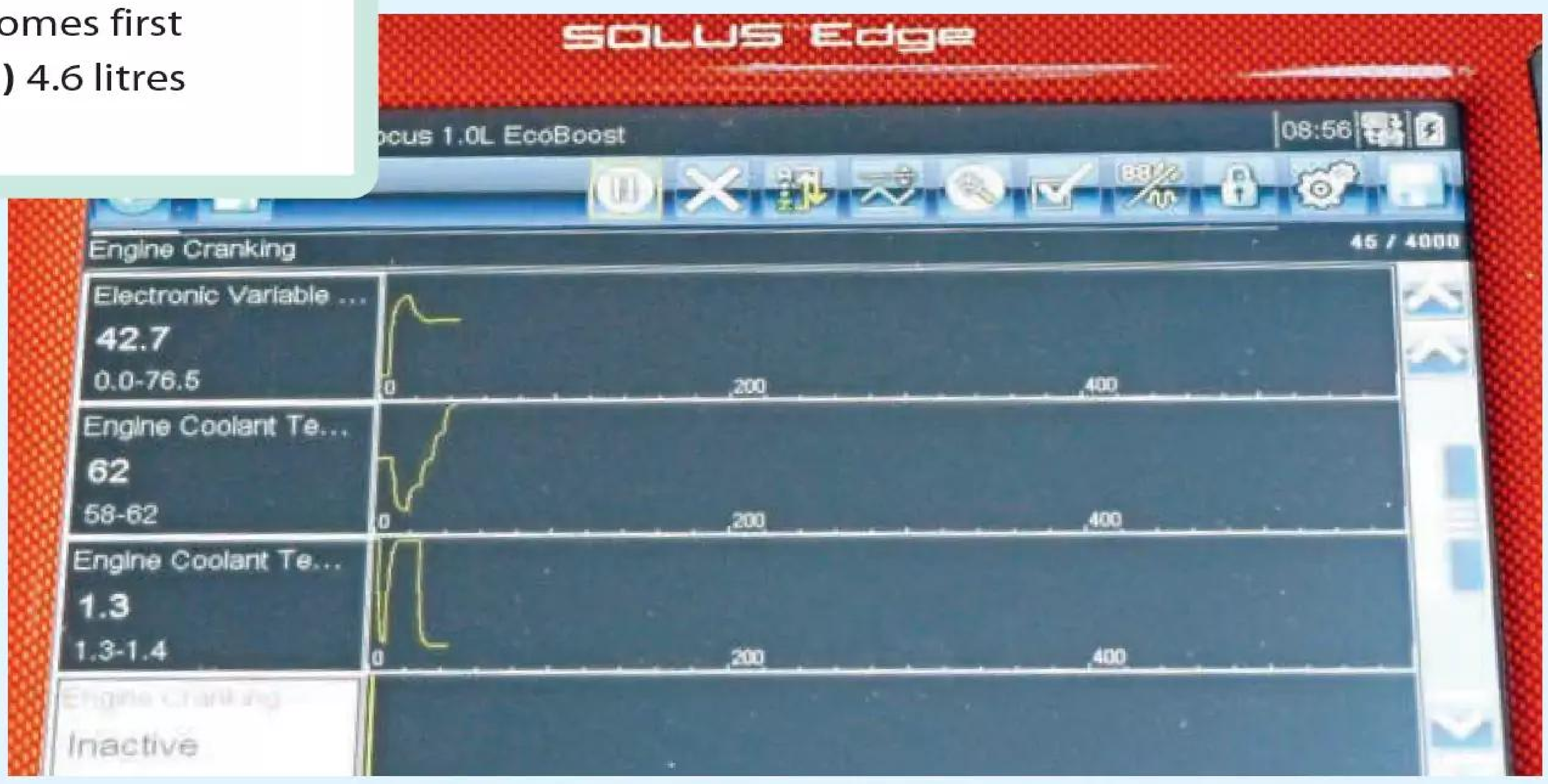
service fill) 4.6 litres



21 **This screenshot of the Solus Edge device shows live data relating to the coolant temperature sensor. Live data can aid fault-finding by showing what information the ECU is receiving. For example, a high temperature reading on a cold engine could indicate that the sensor or its wiring is at fault.**

22 **This is the key-fob assembly for the Focus, which is relatively fragile. Always ensure that the key-fob contains a battery (CR2032) in good condition. We recommend renewing the battery at every major service. If the car can't detect the fob – say, due to low voltage – the engine won't start.**

Electronic Diagnostics

VOLVO XC70 2.4D

Tracing and fixing faults in electronic engine management systems

The Volvo V70 and four-wheel drive XC70 estates can be attractive propositions, but are they good in diagnostic terms? **Kim Henson** and **Edward Haggar** find out.

The first series Volvo V70 estates were introduced in 1996, having evolved from the 850 estates. The four-wheel-drive Cross Country versions made their debut at the 1997 Frankfurt Motor Show. A considerably upgraded second-generation V70 and four-wheel-drive V70 XC models arrived in 2000, with the latter renamed XC70 in 2003.

From 2007 until 2016, much revised third-generation models continued the Volvo estate theme, with all versions notable for their dynamic competence and comfortable accommodation for passengers, plus a large load area. In fact, space for passengers and luggage was even greater than in the predecessors.

A variety of petrol and diesel engines were offered. For this feature we are looking at a 2.4-litre five-cylinder diesel-powered example, first registered in June 2013. Our guide to the diagnostic aspects of this engine and its Bosch EDC17 management system is Edward Haggar.

NOTE:
All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

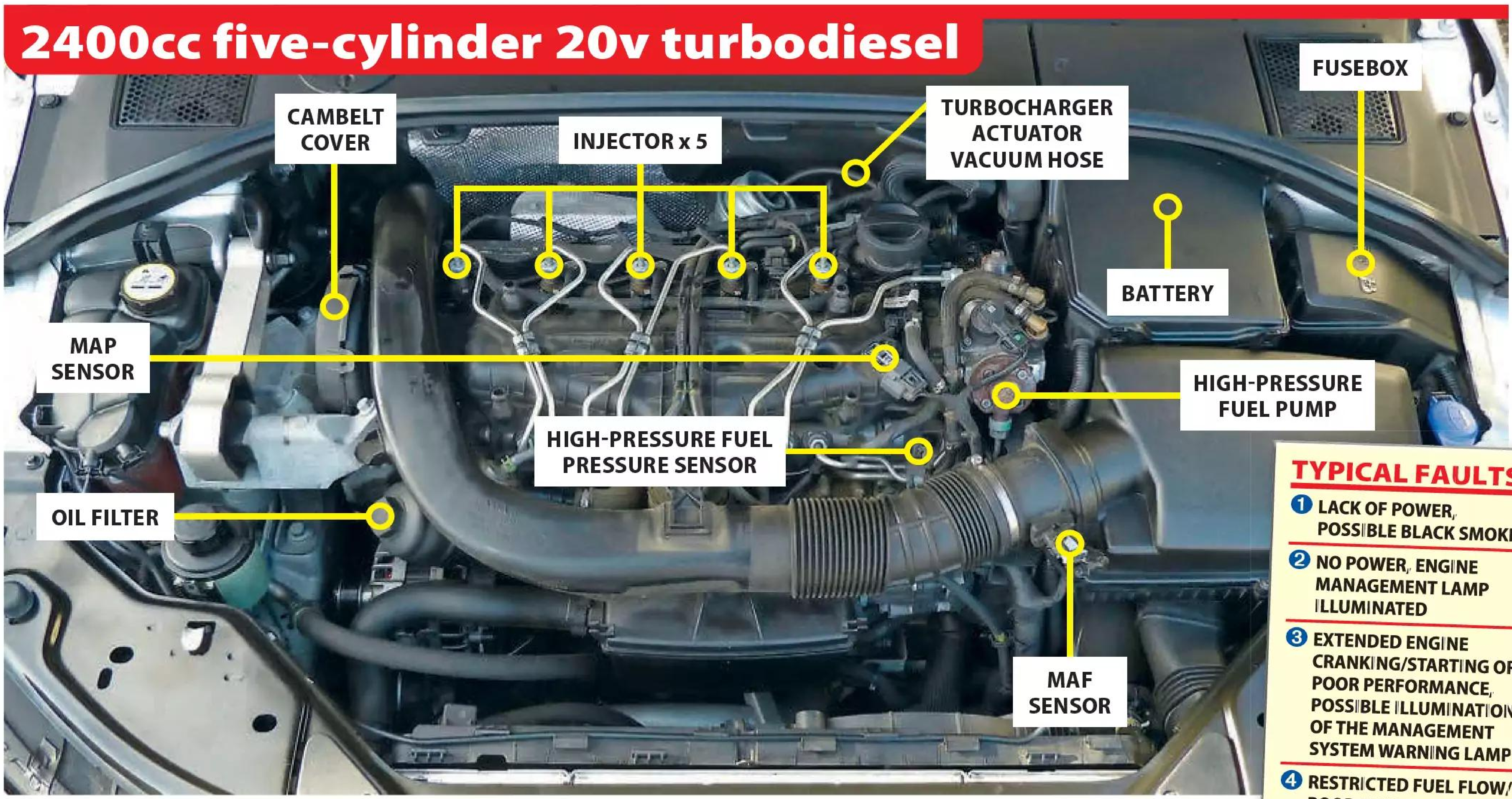
Preparation

For reliable operation and good performance, it's essential for all servicing aspects to be addressed. If the car you are dealing with has no known maintenance history or has not been serviced recently, our recommendation is to carry out a full assessment and service.

In addition to ensuring that the engine oil and filter are renewed, using only oil as recommended by Volvo, and with a high-quality filter to original equipment specification, it is wise to renew the air and fuel filters. Again, always use high-quality filters to original equipment level. Note that a choked fuel filter can lead to poor running due to a restricted supply of fuel to the engine.

It is a good idea to check frequently for deterioration of the underbonnet hoses/pipework, paying special attention to the rubber pipes serving the intercooler. If these are split or leaking, the engine will be low on power (see *Fault 1: Intercooler/pipework issues*).

2400cc five-cylinder 20v turbodiesel



TYPICAL FAULTS

1. LACK OF POWER, POSSIBLE BLACK SMOKE
2. NO POWER, ENGINE MANAGEMENT LAMP ILLUMINATED
3. EXTENDED ENGINE CRANKING/STARTING OR POOR PERFORMANCE, POSSIBLE ILLUMINATION OF THE MANAGEMENT SYSTEM WARNING LAMP
4. RESTRICTED FUEL FLOW/ POOR RUNNING

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is very effective for this Volvo, and also works well with other makes and models.

Fault 1

INTERCOOLER/ PIPEWORK ISSUES

This first fault won't require the use of a diagnostic tool. Symptoms include the engine feeling down on power, plus the possibility of black smoke from the exhaust. Inspect the engine bay, looking at all the rubber intercooler pipes – you will likely see a split in the pipe and oily residue. As a temporary fix the pipe can be taped up, but a replacement hose will be needed.

If you wanted to approach it from a diagnostic view, you can carry out a fault code check and you will likely see codes relating to air mass or boost pressure, but because the split pipe is allowing air leaks it confuses the ECU.

Another area to inspect for leaks is the metal intercooler itself – its location low down at the front of the vehicle is susceptible to holes caused by stone damage. Even a pinprick hole somewhere in the system can cause the ECU to apply 'limp-home' mode. Replacement pipes are readily available at most Volvo dealers.

Fault 2

FAULTY DPF PRESSURE SENSOR

When this fault is present, the driver may not be aware of it until the car becomes virtually undriveable. At this stage, it feels as if somebody is squeezing the fuel line and there's no power. In addition, the engine management light will illuminate, with numerous codes stored relating to the diesel particulate filter (DPF). The DPF will not have been carrying out a regeneration and the filter will have become blocked.

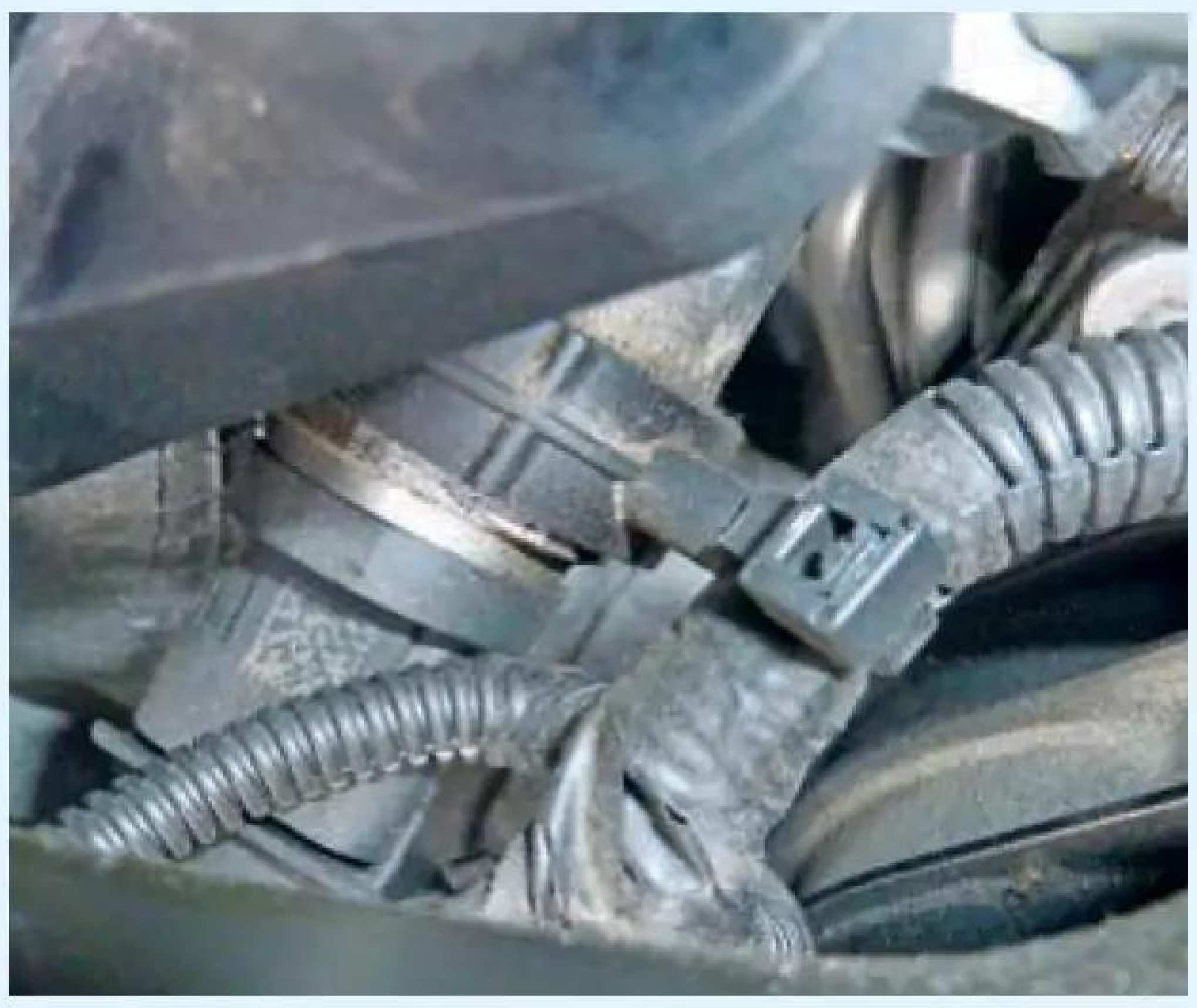
The problem is due to a faulty pressure sensor. A simple multimeter can be used to check voltage at the sensor, which should read 0.5 volts when the filter is empty and 5 volts when it's full. In general, when the sensor fails it will be stuck on 0.5-1 volts, when actually the DPF is blocked, so the reading should be nearer 5 volts. However, be aware that the other wire to the sensor is the 5-volt supply.

Renewing the sensor simply involves disconnecting two pipes and a clip.

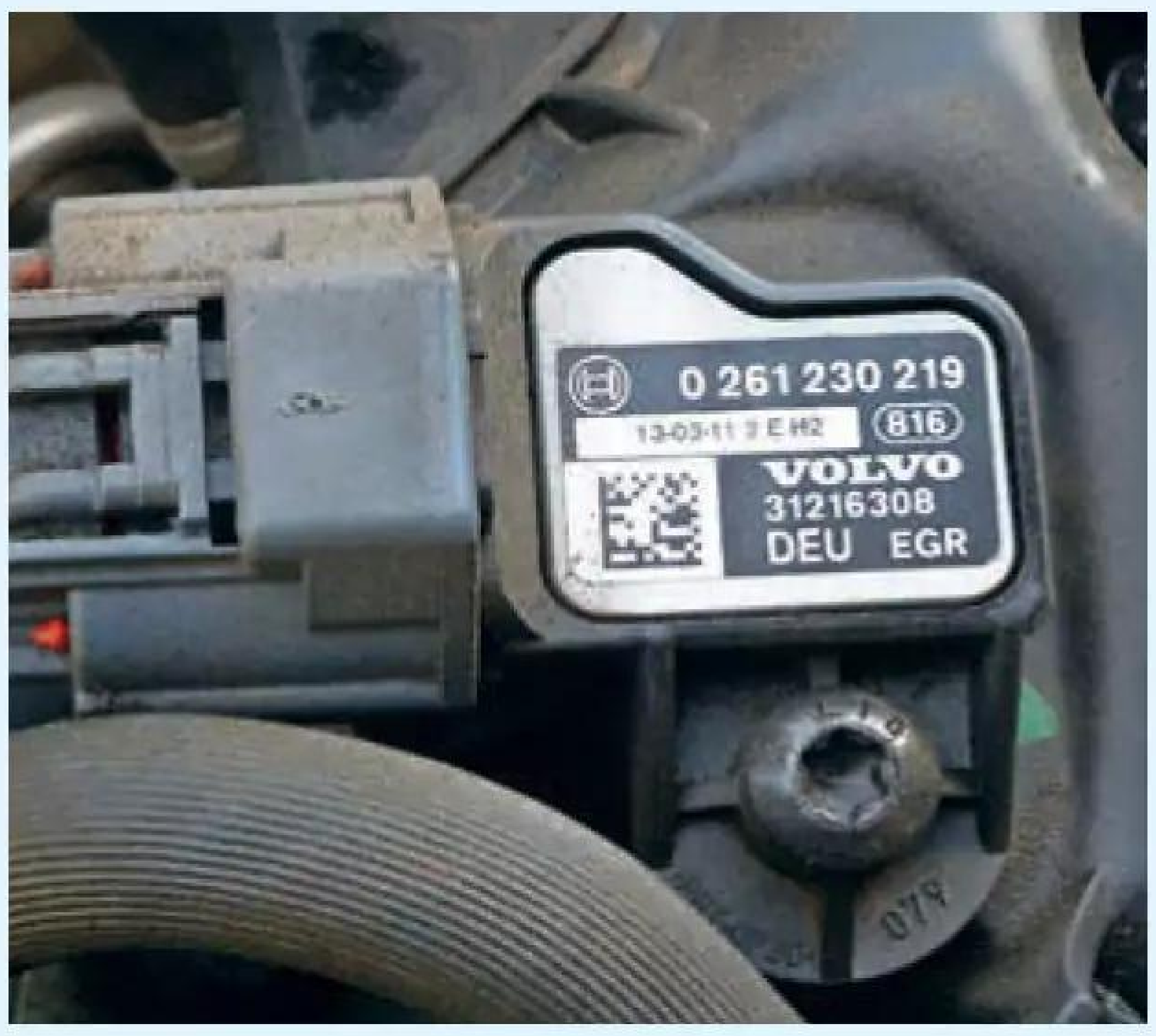
Typical Volvo XC70 components

1 To get access to the upper part of the engine, the large plastic cover panel has to be removed. On this car, the cover is held in place by push-fit clips, but on early vehicles you will need a 10mm spanner to release the securing screws.

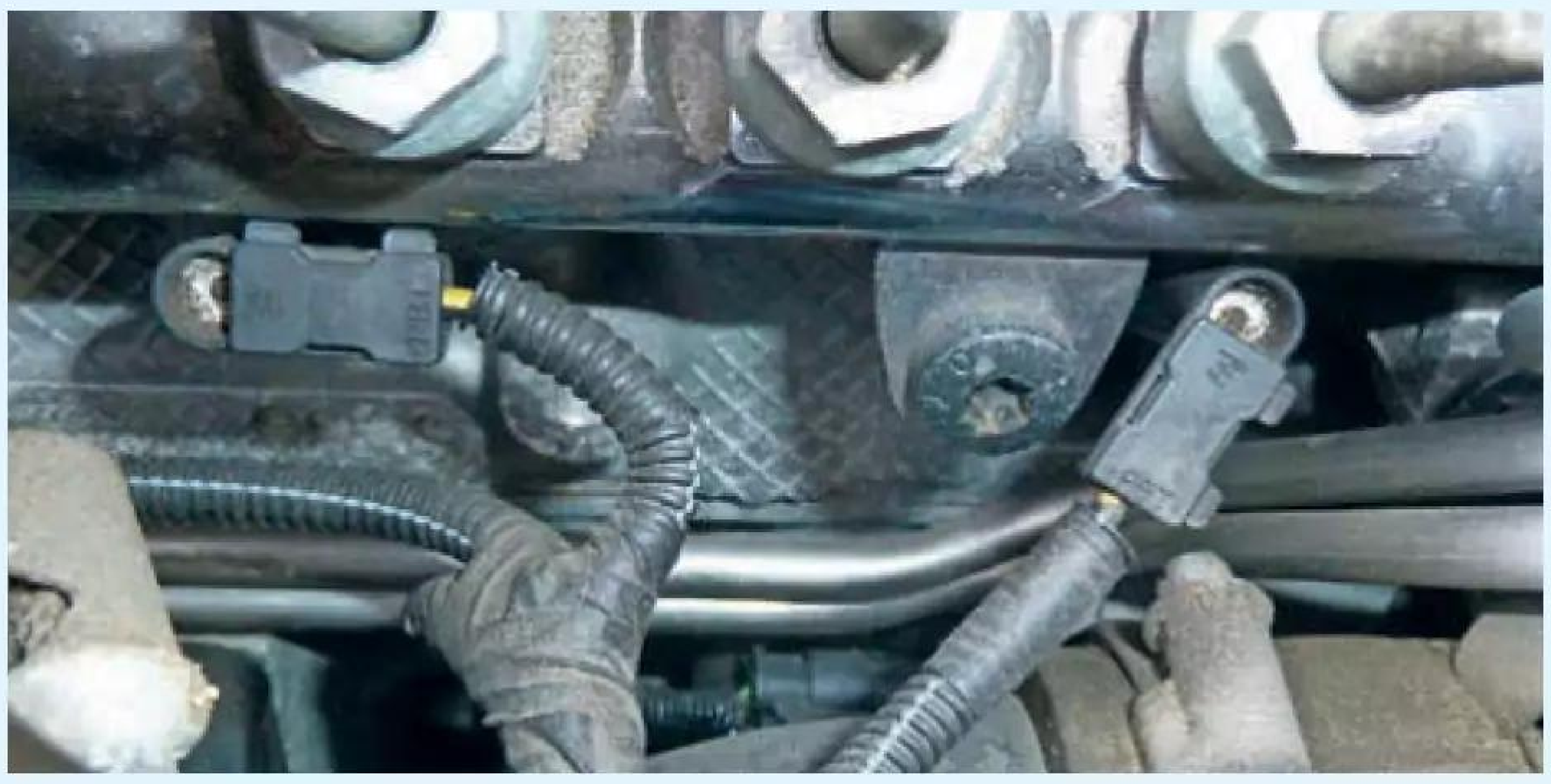
2 The five fuel injectors are individually coded with identifying numbers on the body of each unit. If the injectors are replaced, new ones need to be coded via the ECU using suitable diagnostic equipment, such as the SOLUS Edge.



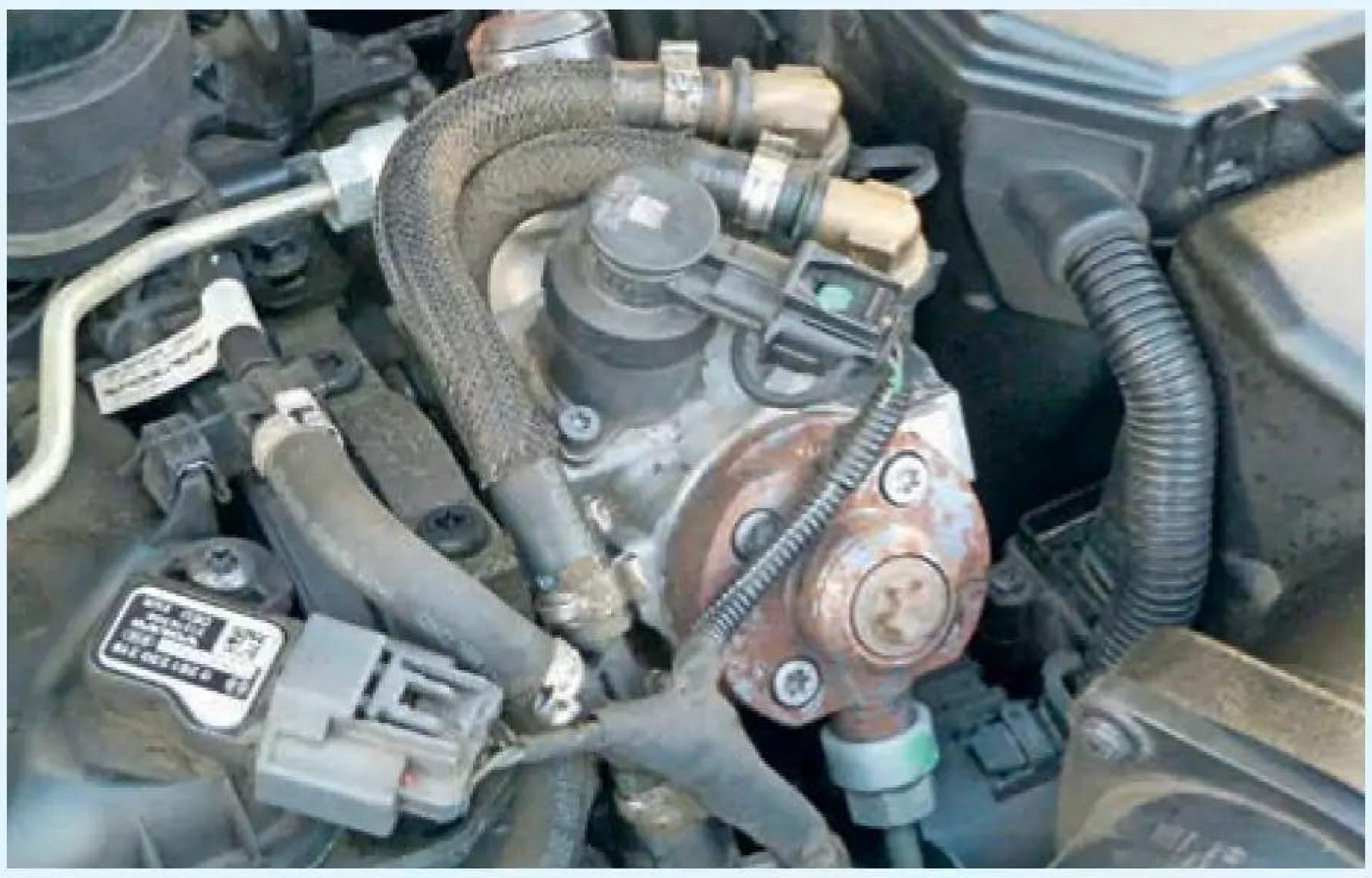
3 Rather hidden away at the right-hand end of the fuel rail is the fuel pressure sensor. As its name implies, its function is to constantly monitor the pressure of the fuel within the rail, feeding this information to the ECU to help determine fuelling levels.



4 Located at the left-hand end of the inlet manifold is the mass absolute pressure (MAP) sensor. It monitors the pressure within the manifold, relaying the information to the ECU to help determine required fuel supply levels.



5 ◀ The glow plugs are accessibly positioned at the front of the engine. They are usually easy to renew, but it is worth soaking them with penetrating fluid prior to attempting to remove them.



6 ▶ Vital to the fuel system is the high-pressure diesel pump, which on this XC70 is found on the left-hand side of the cylinder-head. Ensure that there are no fuel leaks in the vicinity.

ENGINE MANAGEMENT

The Bosch EDC17 management system used on this XC70 incorporates these primary components:

- Digital camshaft and crankshaft sensors.
- Pre- and post-oxygen sensors.
- Diesel particulate filter pressure sensor mounted in DPF.
- Piezo-type fuel injectors.
- DPF temperature sensor located in DPF.
- High-pressure fuel pump fitted on the side of the cylinder-head.
- ABS pump with the control unit mounted on it.
- MAF sensor positioned within the air filter trunking.
- Fuel pressure sensor mounted at the end of the fuel rail.
- Digital wheel speed sensors.
- Five-cylinder engine exhaust gas recirculation (EGR) valve with position feedback.

Fault 3

FAULTY EGR VALVE

Depending on the way in which the next fault occurs the driver might or might not have an engine warning light illuminated, or the car may suffer from extended cranking/starting or poor performance. The fault is actually with the exhaust gas recirculation (EGR) valve. Carry out an initial fault code check and you will find the code 'P140700 – EGR no flow'. You could try removing the valve to clean it, as it's fairly easy to access.

Use your tester to read off the EGR live data. The valve probably won't operate, indicating a fault. Some diagnostic tools come with an EGR function, in which the ECU tries to operate the valve while carrying out a self-test function with a simple pass or fail result.

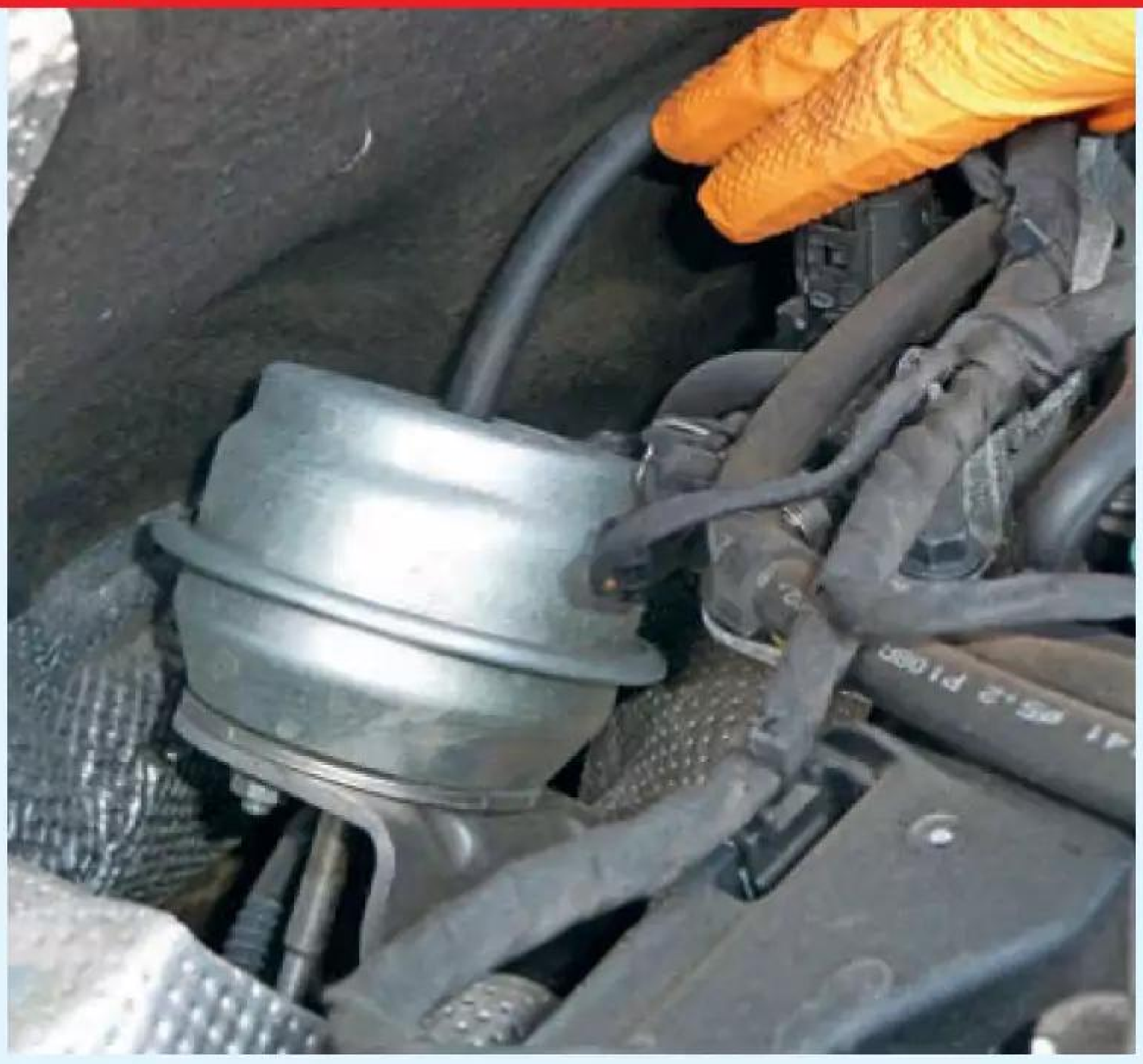
Fault 4

BLOCKED FUEL FILTER

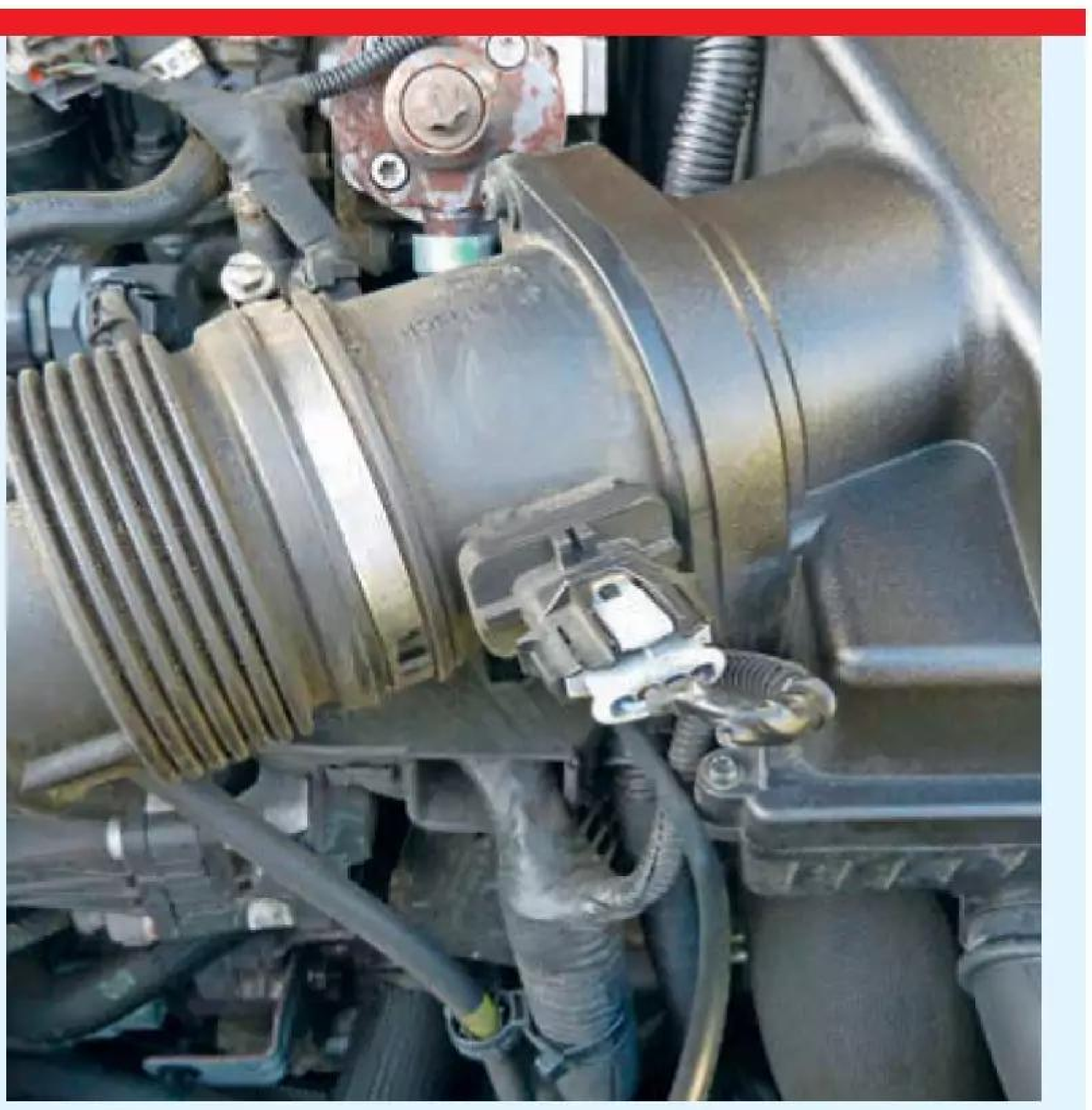
When our fourth fault is present the Volvo will not drive properly as the fuel supply is being restricted. In such situations it's always worth looking first at the diesel fuel filter. We have heard of vehicles on which garages have spent hundreds – and sometimes thousands – of pounds trying to fix a fault that turns out to be nothing more than a blockage in the filter.

This problem doesn't just affect Volvos, but vehicles from all manufacturers. If there's no service history with the vehicle or you can't see a new filter, it should be changed regardless. People often assume that with the manufacturer-recommended high mileage/time intervals between services these days, the filters just don't need changing, but in our experience they still do.

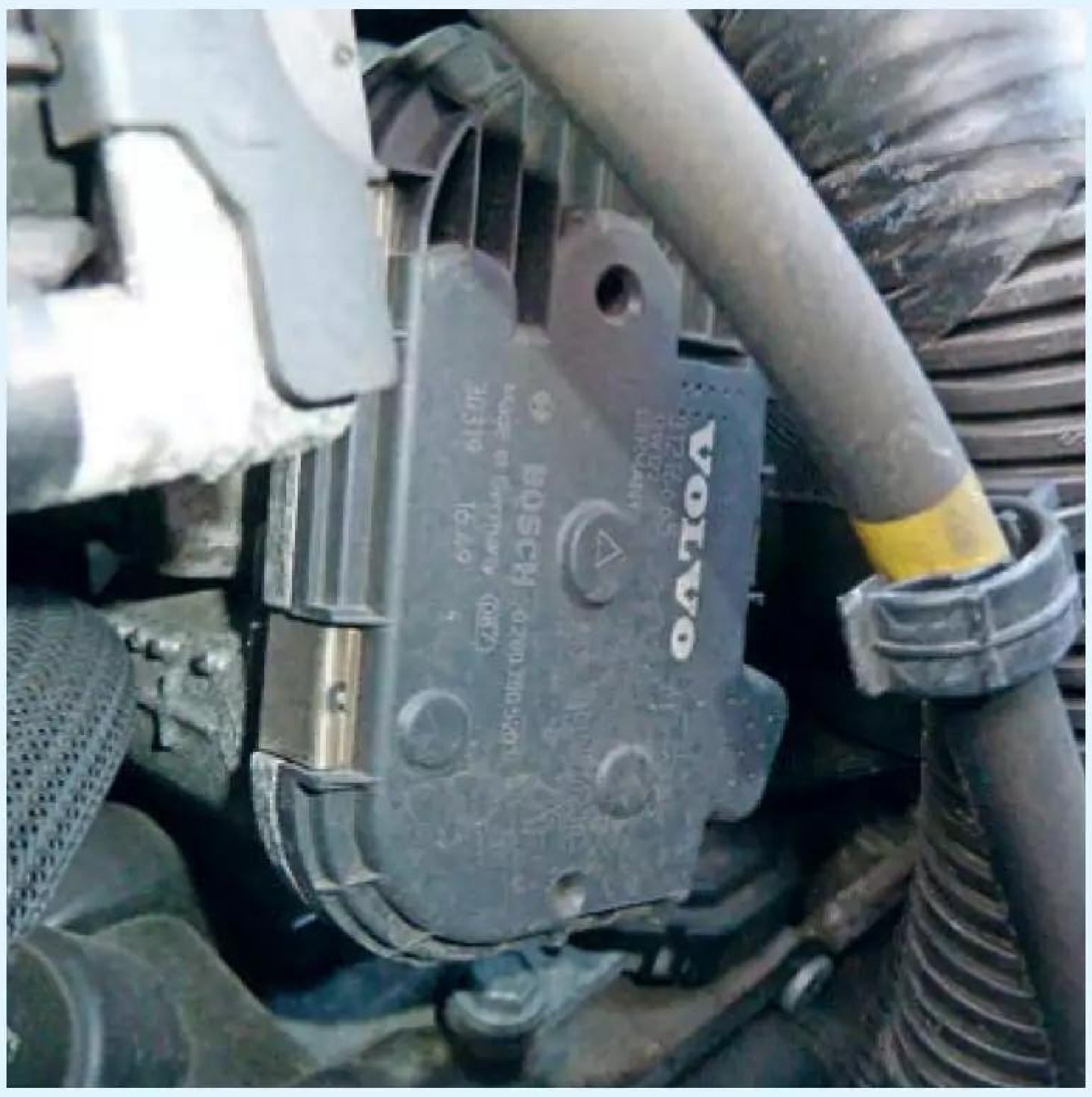
Typical Volvo XC70 components



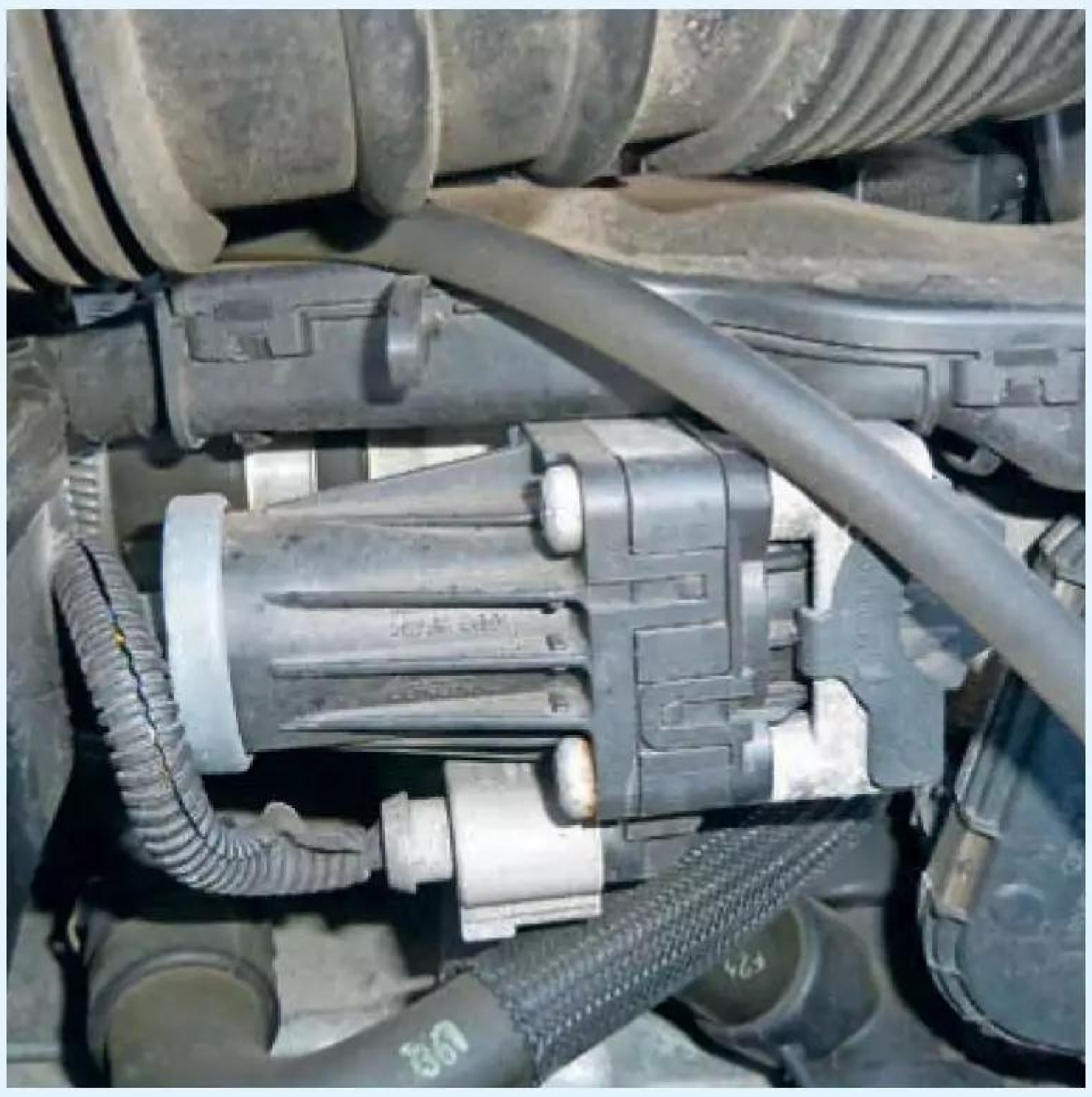
7 ◀ **Problems can arise with this turbocharger actuator vacuum hose. The hose can split, resulting in loss of vacuum and consequent performance loss. It pays to frequently check the condition and security of the hose.**



8 ▶ **The mass airflow (MAF) sensor is positioned within the intake trunking. It operates by monitoring the rate of air passing through the system, sending the information to the ECU. Always use a high-quality air filter, to avoid possible contamination of the sensor.**

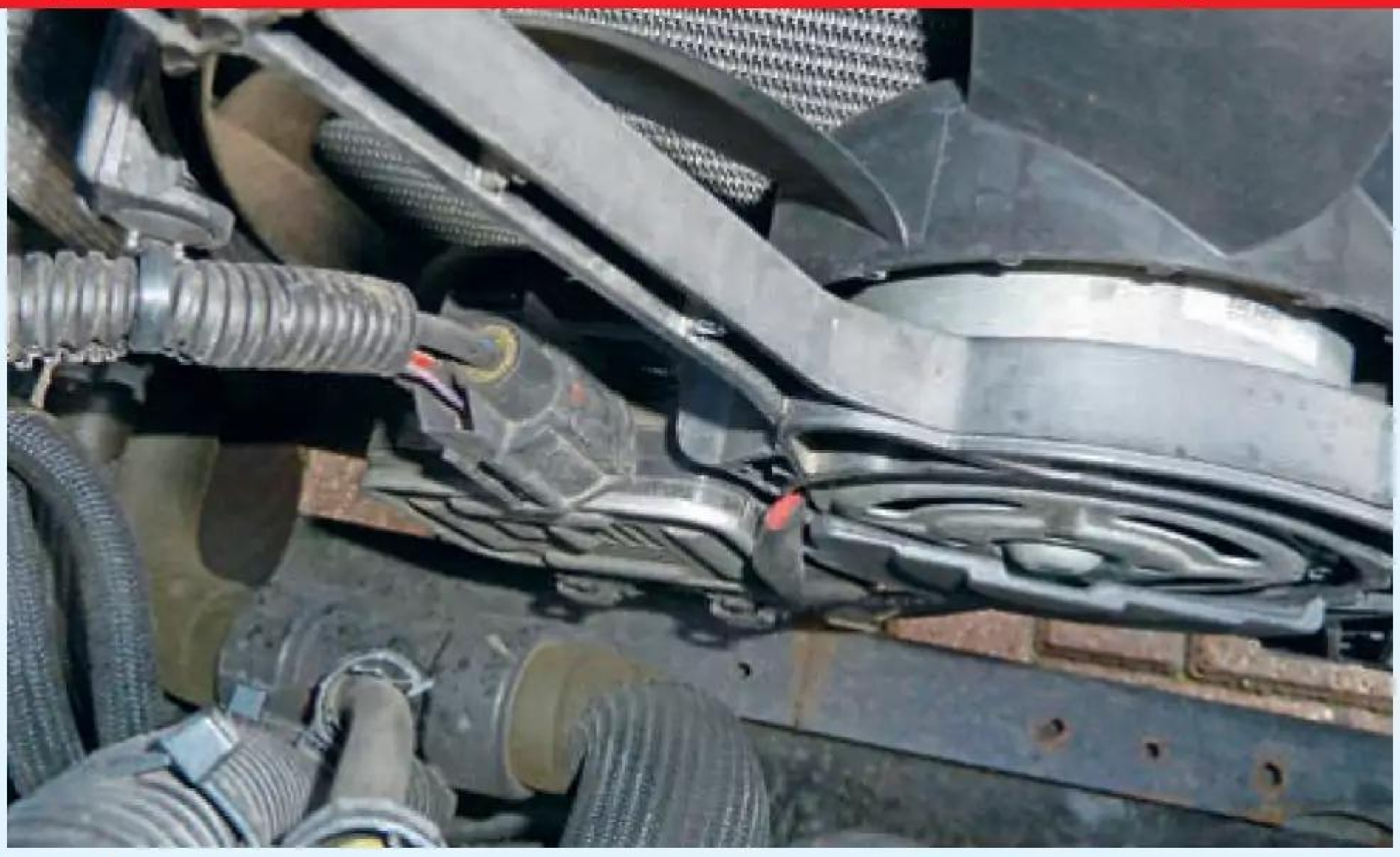


9 ◀ **Found beneath the air filter trunking at the front of the engine bay is the motorised throttle body assembly. With the air filter removed – such as during filter changes – it is worth gently cleaning out the throttle body unit.**

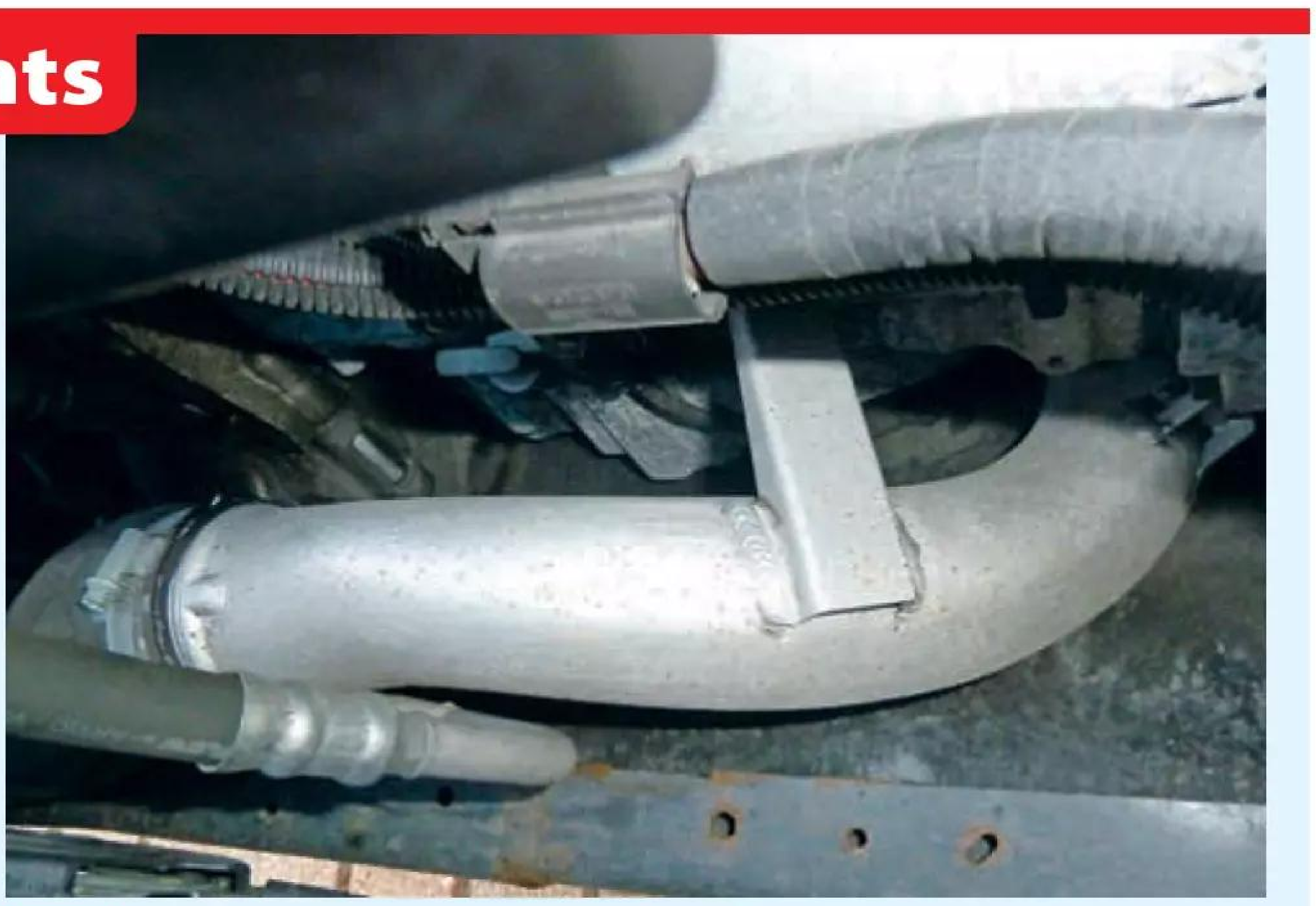


10 ▶ **A vital part of the intake system is the exhaust gas recirculation (EGR) valve, located just to the right-hand side of the throttle body assembly. The EGR valve recirculates exhaust gases through the engine, helping to minimise nitrogen oxide (NOx) emissions.**

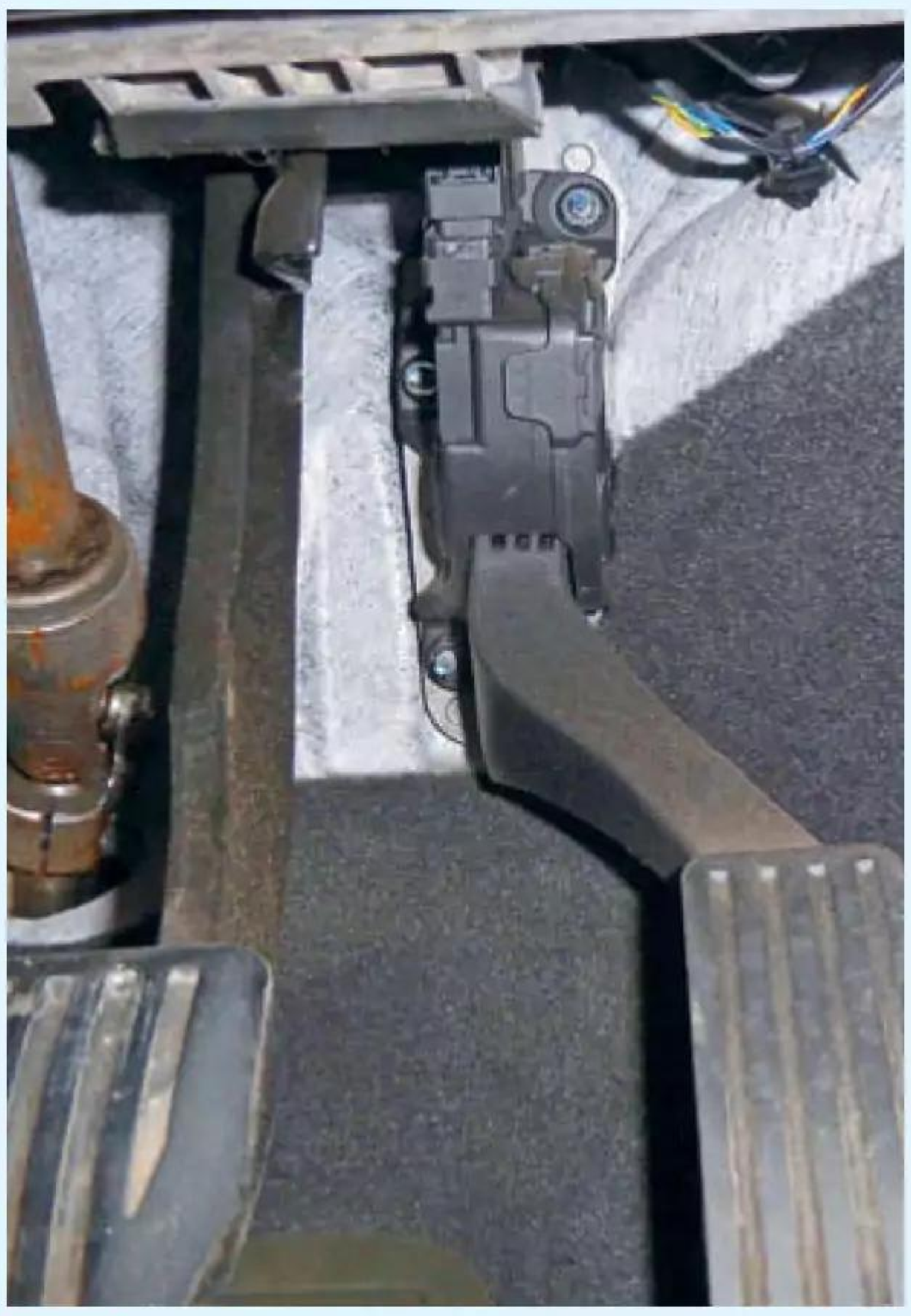
Typical Volvo XC70 components



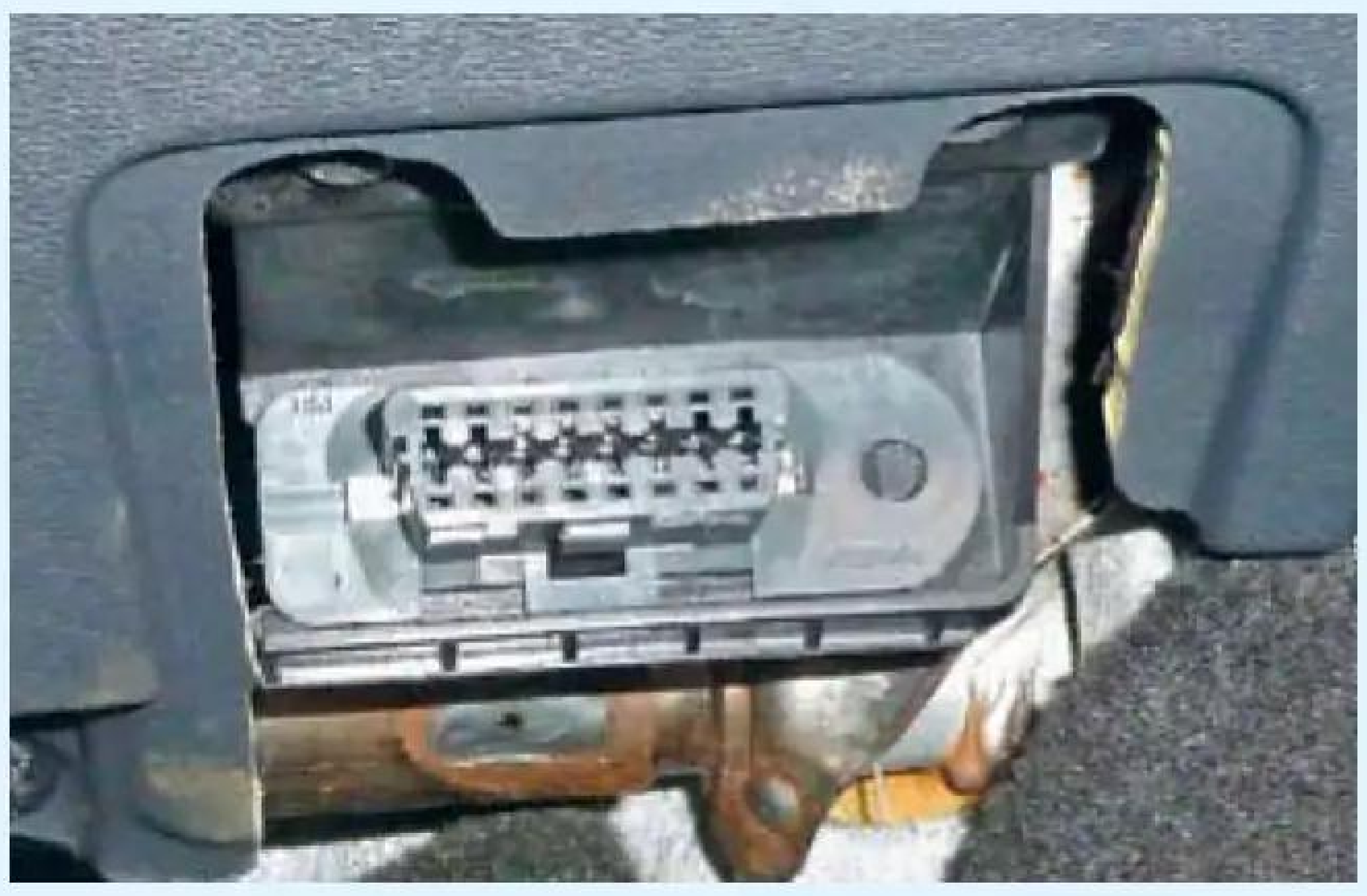
11 **Shown here is the engine cooling fan with adjacent control module, seen just to the centre of the fan hub/motor in this photograph. Check the condition of the wiring and connections and ensure the electric fan cuts in/out as required.**



12 **This intercooler trunking is found low down within the engine compartment. It supplies the turbocharger with air. Ensure that the trunking is sound and its hose connections are secure. Note that splits/cuts can cause air leaks and result in black smoke.**

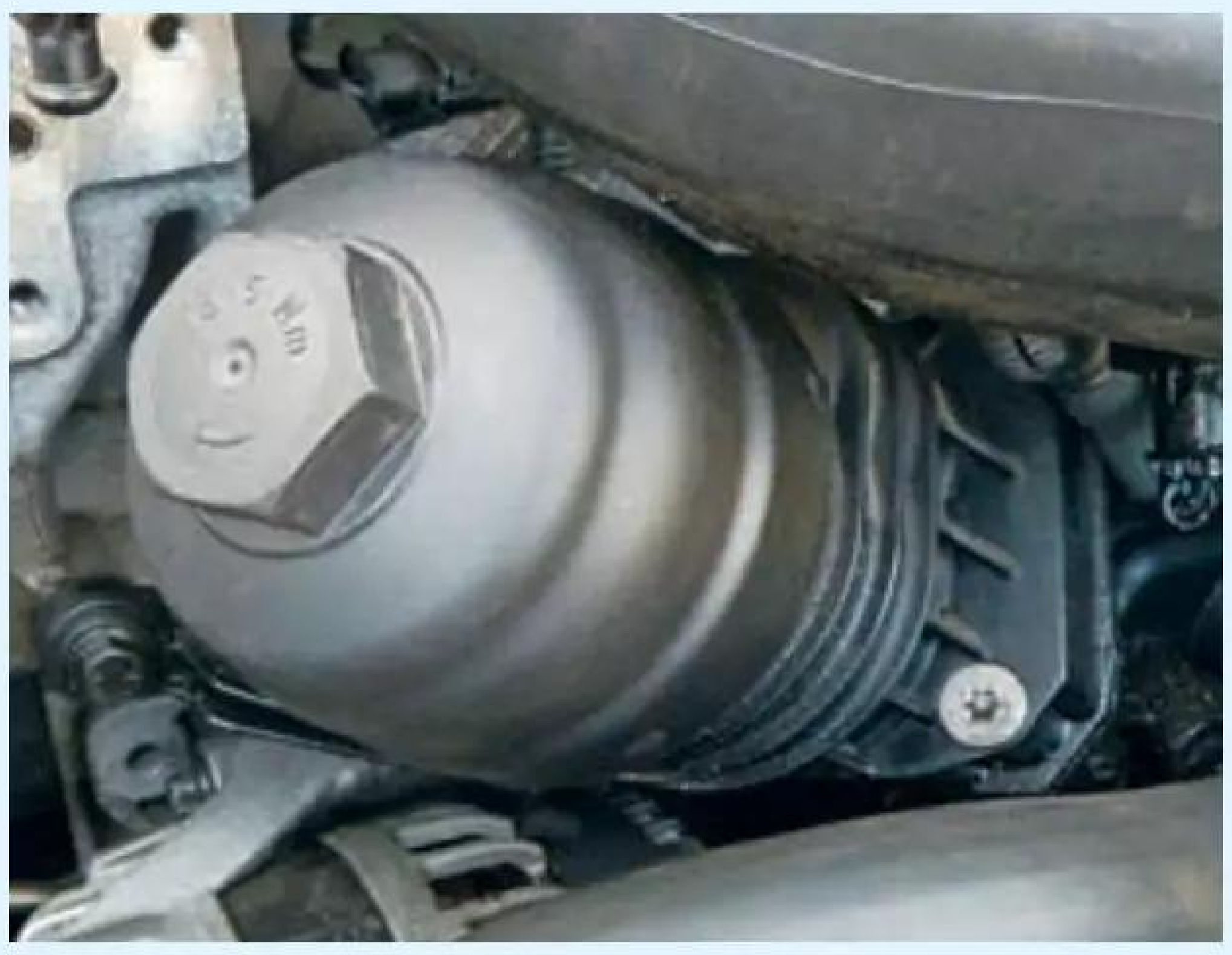


13 **As part of the drive-by-wire throttle actuation system, the essential throttle pedal position sensor is integral with the throttle pedal.**

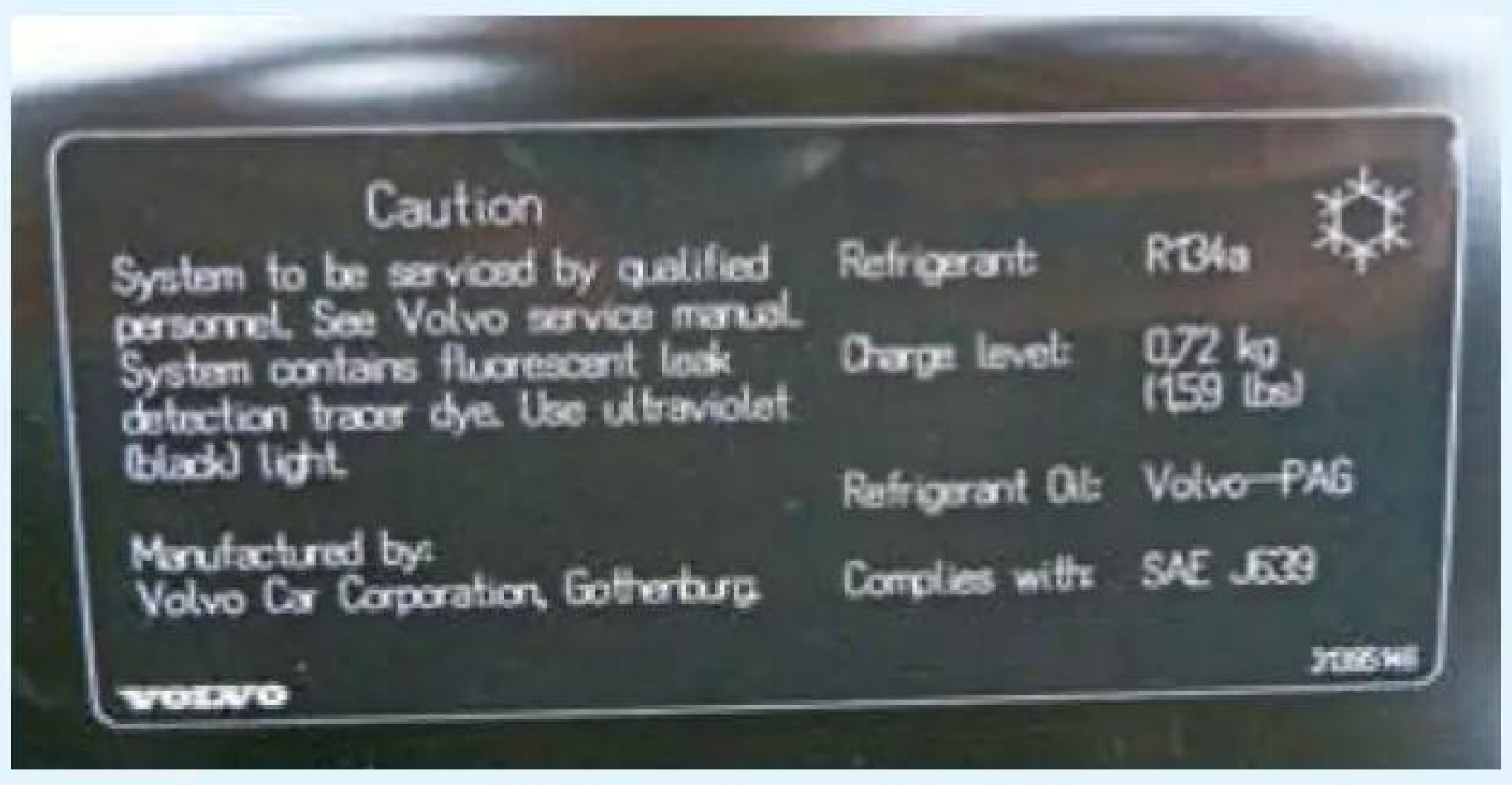


14 **The vehicle's diagnostic socket is positioned at the lower edge of the fascia assembly, on the right-hand side.**

16 **Strictly speaking, the headlights are not part of the engine management set-up. However, if a headlamp bulb needs to be changed, each light assembly can be easily released for access to the bulb by carefully lifting the securing clip.**



15 **The oil filter is easy to reach and change. However, when swapping the filter, ensure that no oil runs into the alternator, located just beneath the filter. On reassembly, tighten the filter housing to 25Nm plus 5Nm.**



Caution

System to be serviced by qualified personnel. See Volvo service manual. System contains fluorescent leak detection tracer dye. Use ultraviolet (black) light.

Manufactured by:
Volvo Car Corporation, Gothenburg

Refrigerant:	R134a
Charge level:	0.72 kg (1.59 lbs)
Refrigerant Oil:	Volvo–PAG
Complies with:	SAE J639

17 **On the engine bay's forward cross-panel is a useful label providing details of the air-conditioning system refrigerant, including type and the quantity and charge level required.**

Technical Specs

Actual values

Component	Value
High fuel pressure, idling	300 Bar
High fuel pressure, 3000 rpm	1800 Bar
DPF pressure sensor, idling	0.5 volts not blocked
DPF pressure sensor, idling	5 volts blocked
Crank sensor	5 volts supply
EGR valve actuator	6 ohms
MAF sensor	12 volts supply

USEFUL DATA

These are the official recommended change intervals for the various components. However, we strongly advise that the other service/change intervals are at least halved.

Service interval Every 18,000 miles or 12 months, whichever comes first.

Cambelt At least every 108,000 miles or 120 months.

Air filter and fuel filter Every 36,000 miles, regardless of time interval.

Engine oil Every 18,000 miles or 12 months, whichever comes first.

Oil type SAE 0W-30 fully-synthetic ACEA/B5.

Capacity (service fill) 5.9 litres.

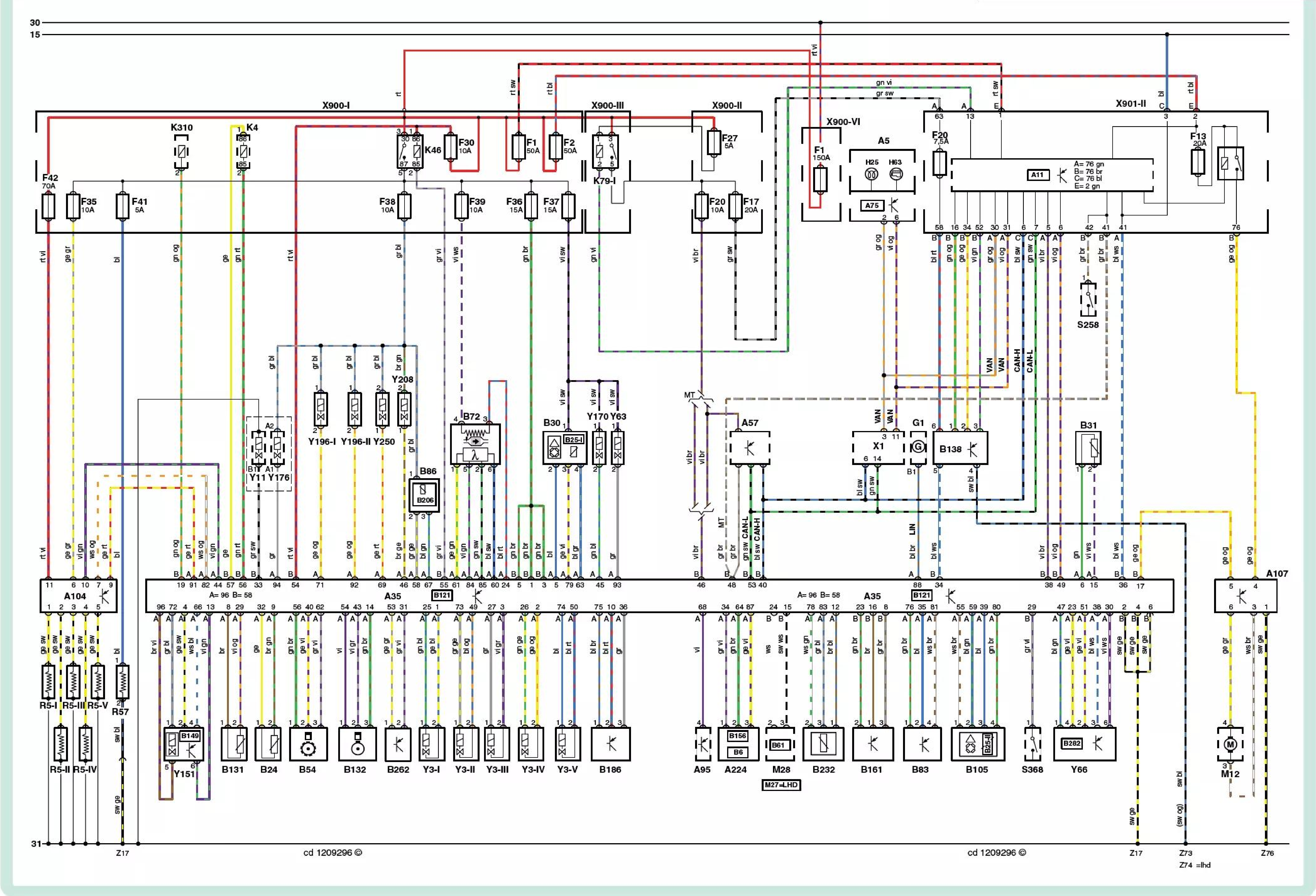
Oil filter torque setting 25Nm.

Sump plug torque setting 38Nm.

Brake fluid Every two years.

BOSCH EDC17 CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
31
X900-I
X900-III
X900-II
X900-VI
X901-II
K310
K4
K46
K79-I
F42 70A
F35 10A
F41 5A
F38 10A
F30 10A
F1 50A
F2 50A
F39 10A
F36 15A
F37 15A
F27 5A
F20 10A
F17 20A
F1 150A
F20 7,5A
F13 20A
A5
H25
H63
A75
A11
A= 76 gn
B= 76 br
C= 76 bl
E= 2 gn
S258
VAN
CAN-H
CAN-L
Y208
Y196-I
Y196-II
Y250
B72
B86
B206
B30
B25-I
Y170
Y63
Y11
Y176
MT
A57
X1
G1
B138
B31
A104
A35
A= 96 B= 58
B121
A107
R5-I
R5-III
R5-V
R57
R5-II
R5-IV
B149
Y151
B131
B24
B54
B132
B262
Y3-I
Y3-II
Y3-III
Y3-IV
Y3-V
B186
A95
B156
B6
A224
B61
M28
M27=LHD
B232
B161
B83
B105
S368
B282
Y66
M12
Z17
Z73
Z74 =lhd
Z76
cd 1209296 ©
cd 1209296 ©

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A104	GLOW PLUG CONTROL MODULE
A107	FUEL PUMP CONTROL MODULE
A224	ENGINE OIL SENSOR MODULE
B6	ENGINE OIL PRESSURE SENSOR
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25-I	INTAKE AIR TEMPERATURE (IAT) SENSOR | 1
B25-II	INTAKE AIR TEMPERATURE (IAT) SENSOR | 2
B30	MASS AIRFLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B61	OUTSIDE AIR TEMPERATURE SENSOR
B72	HEATED OXYGEN SENSOR (HO2S)
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B86	ENGINE OIL LEVEL SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B121	BAROMETRIC PRESSURE (BARO) SENSOR
B131	EXHAUST GAS TEMPERATURE SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B149	EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR
B156	ENGINE OIL TEMPERATURE SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B206	ENGINE OIL QUALITY SENSOR
B232	DIESEL PARTICULATE FILTER (DPF) PRESSURE SENSOR
B262	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR
B282	INTAKE AIR FLAP CONTROL ACTUATOR POSITION SENSOR
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
F	FUSE
G1	ALTERNATOR
H25	GLOW PLUG WARNING LAMP
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K4	STARTER MOTOR RELAY
K46	ENGINE CONTROL (EC) RELAY
K79-I	IGNITION MAIN CIRCUITS RELAY | 1
K310	FUEL FILTER HEATER RELAY
M12	FUEL PUMP (FP)
M27	DOOR MIRROR ADJUSTMENT MOTOR, DRIVER
M28	DOOR MIRROR ADJ MOTOR, PASSENGER
R5-I	GLOW PLUG | 1
R5-II	GLOW PLUG | 2
R5-III	GLOW PLUG | 3
R5-IV	GLOW PLUG | 4
R5-V	GLOW PLUG | 5
R57	CRANKCASE BREATHER HEATER
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S368	TRANSMISSION GEAR POSITION SWITCH
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | 1
X900-II	FUSEBOX/RELAY PLATE, ENGINE BAY | 2
X900-III	FUSEBOX/RELAY PLATE, ENGINE BAY | 3
X900-VI	FUSEBOX/RELAY PLATE, ENGINE BAY | 6
X901-II	FUSEBOX/RELAY PLATE, FASCIA 2
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y3-V	INJECTOR | 5
Y11	AC COMPRESSOR CLUTCH
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y66	INTAKE AIR FLAP CONTROL ACTUATOR
Y151	EXHAUST GAS RECIRCULATION (EGR) VALVE ACTUATOR
Y170	FUEL RAIL PRESSURE (FRP) CONTROL VALVE
Y176	AC COMPRESSOR VARIABLE DISPLACEMENT SOLENOID
Y196-I	TURBOCHARGER (TC) CONTROL SOLENOID | 1
Y196-II	TURBOCHARGER (TC) CONTROL SOLENOID | 2
Y208	EXHAUST GAS RECIRCULATION (EGR) COOLER BYPASS VALVE
Y250	OIL JET PISTON COOLING CONTROL SOLENOID
Z17	ENGINE BAY, BEHIND LH HEADLAMP
Z73	UNDER FRONT SEAT, RH CROSSMEMBER
Z74	UNDER FRONT SEAT, LH CROSSMEMBER
Z76	UNDER REAR SEAT, LH
15	IGNITION SWITCH – IGNITION ON
30	BATTERY +
31	BATTERY –

Electronic Diagnostics

SAAB 9-3 2.0 PETROL

Tracing and fixing faults in electronic engine management systems

Stylish, solid, fast and comfortable, the petrol-powered 2.0-litre Saab 9-3 is a true drivers' car. But is it diagnostically delightful? **Kim Henson** and **Edward Haggar** lift the lid on a 2002 example.

The first-generation Saab 9-3 arrived for the 1998 model year and was based on the previous 900. Buyers could choose between a 2.0- or 2.3-litre petrol or 2.2-litre turbodiesel engine, with all variants transversely mounted and front-wheel-drive. Bodywork options included three- or five-door hatchbacks or a two-door convertible. A heavily revised second-generation 9-3 was introduced for 2003. Subsequent 9-3 models were made until 2014.

For this feature we are looking at a turbocharged 2.0-litre four-cylinder petrol-powered example, first registered in January 2002. The engine on this car incorporates 16 valves and twin overhead camshafts and features Saab's Direct Ignition set-up.

Our guide to the diagnostic aspects of this engine (code number B205E) and its Trionic T7 management system is Edward Haggar.

NOTES:
All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

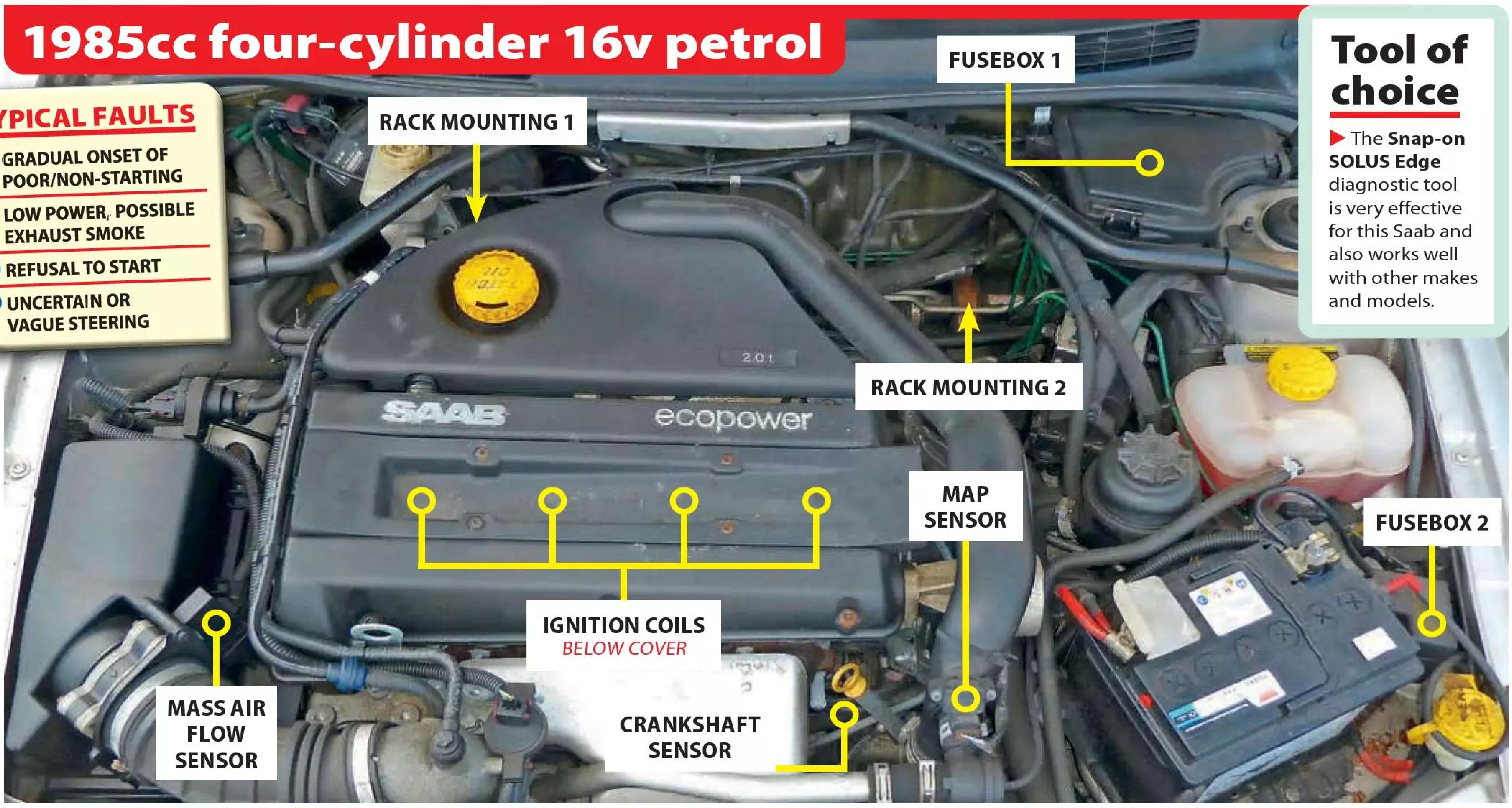
Preparation

On these turbocharged 9-3 models it is essential that the engine oil and filter are changed frequently and regularly or it will adversely affect the turbocharger (see *Fault 2: Turbocharger failure*). Check the maintenance history of the vehicle and, if in any doubt about the last service, carry out a full service and renew the engine oil and filter, using oil to the recommended specification and OE quality parts.

It is also important to assess the condition of all the rubber hoses within the engine bay, ensuring that there are no splits, as the slightest air leak can cause running performance issues.

If serviced regularly, these engines can clock up massive mileages. There is no cambelt to worry about, but it is not uncommon for auxiliary drivebelt issues to arise – the tensioners can become noisy, so it's wise to renew it sooner rather than later. We have seen vehicles where the tensioner fails and the drivebelt jumps and wraps itself around the crankshaft.

1985cc four-cylinder 16v petrol



TYPICAL FAULTS

1. GRADUAL ONSET OF POOR/NON-STARTING
2. LOW POWER, POSSIBLE EXHAUST SMOKE
3. REFUSAL TO START
4. UNCERTAIN OR VAGUE STEERING

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is very effective for this Saab and also works well with other makes and models.

ENGINE MANAGEMENT

The Trionic T7 management system used on this Saab incorporates these primary components:

- Pre- and post-catalytic converter oxygen sensors.
- Coolant temperature sensor.
- Mass air flow sensor.
- Crankshaft position sensor.
- Ignition coil pack.
- 4 x conventional solenoid-type fuel injectors.
- In-tank fuel pump.
- Throttle position sensor mounted on throttle pedal.
- Turbocharger with boost actuator.

Fault 1

CRANKSHAFT POSITION SENSOR

With this first fault, the engine will not start or will gradually suffer from poor starting. This may be worse when the engine is hot, with possible cutting-out.

The problem lies with the crankshaft position sensor failing internally and causing a break in the system, hence the ECU loses its rpm signal and thinks that the engine has stopped.

Fault diagnosis can be carried out in a few ways, depending on the situation. If the vehicle is in a complete 'non-start' situation, you can go directly to the crank sensor and carry out a resistance check which will show open-circuit. If the vehicle is cutting-out, it can be helpful to look at actual values – live data will show the rpm signal cutting out.

The crank sensor is located at the front of the engine on the right-hand side, hidden behind the exhaust heat shield. After removing the heat shield, undo the Torx 30 fastener to release the sensor. If the fastener has seized, apply penetrating oil and leave it to soak, then try again – bear in mind that, if you do snap it off, it is a major job to remove it.

Fault 2

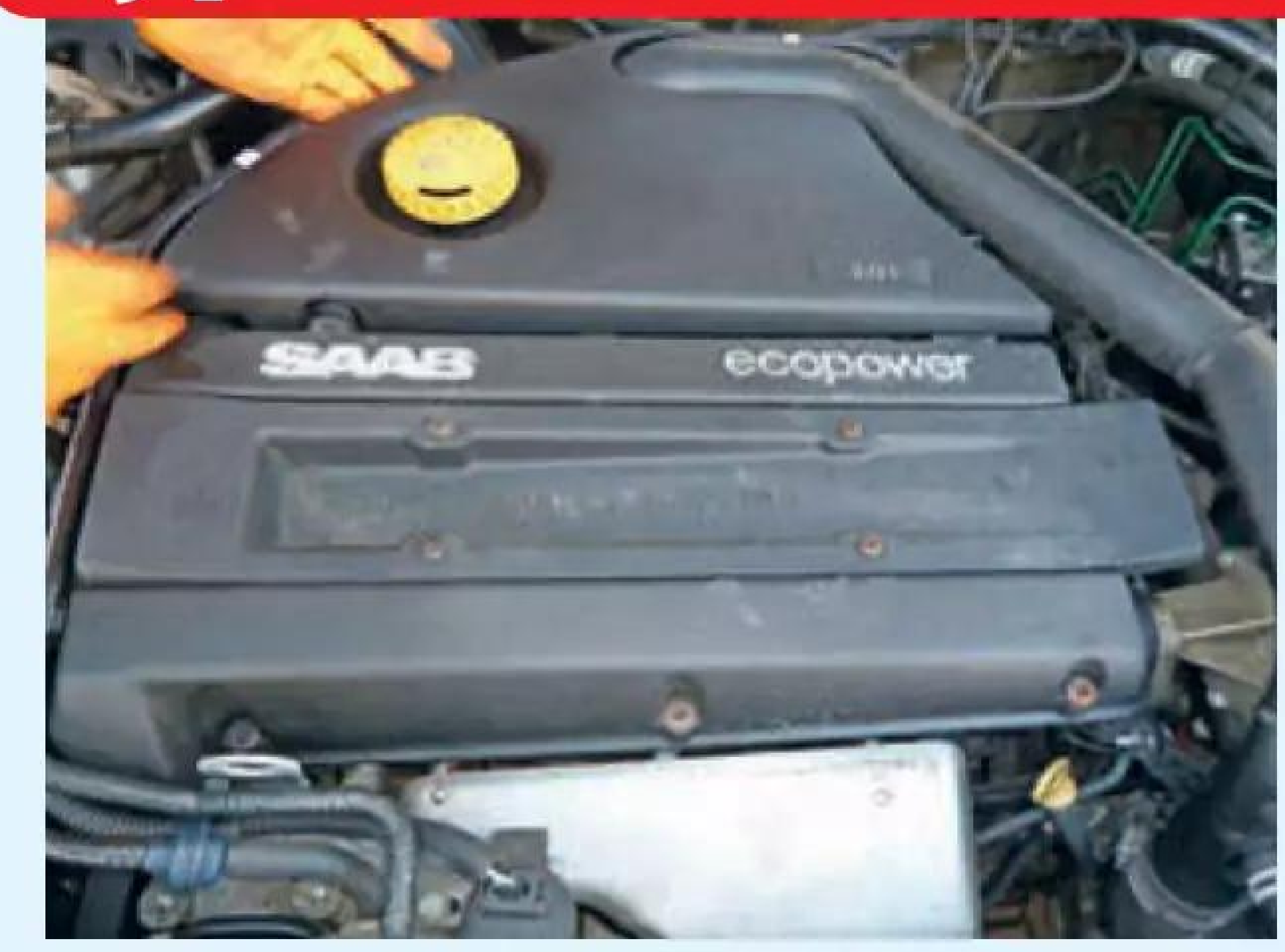
TURBOCHARGER FAILURE

This is a mechanical fault and the driver will notice that the car doesn't have the performance punch it used to, It's also possible there may be a slight puff of blue smoke from the exhaust. The problem lies within the turbocharger.

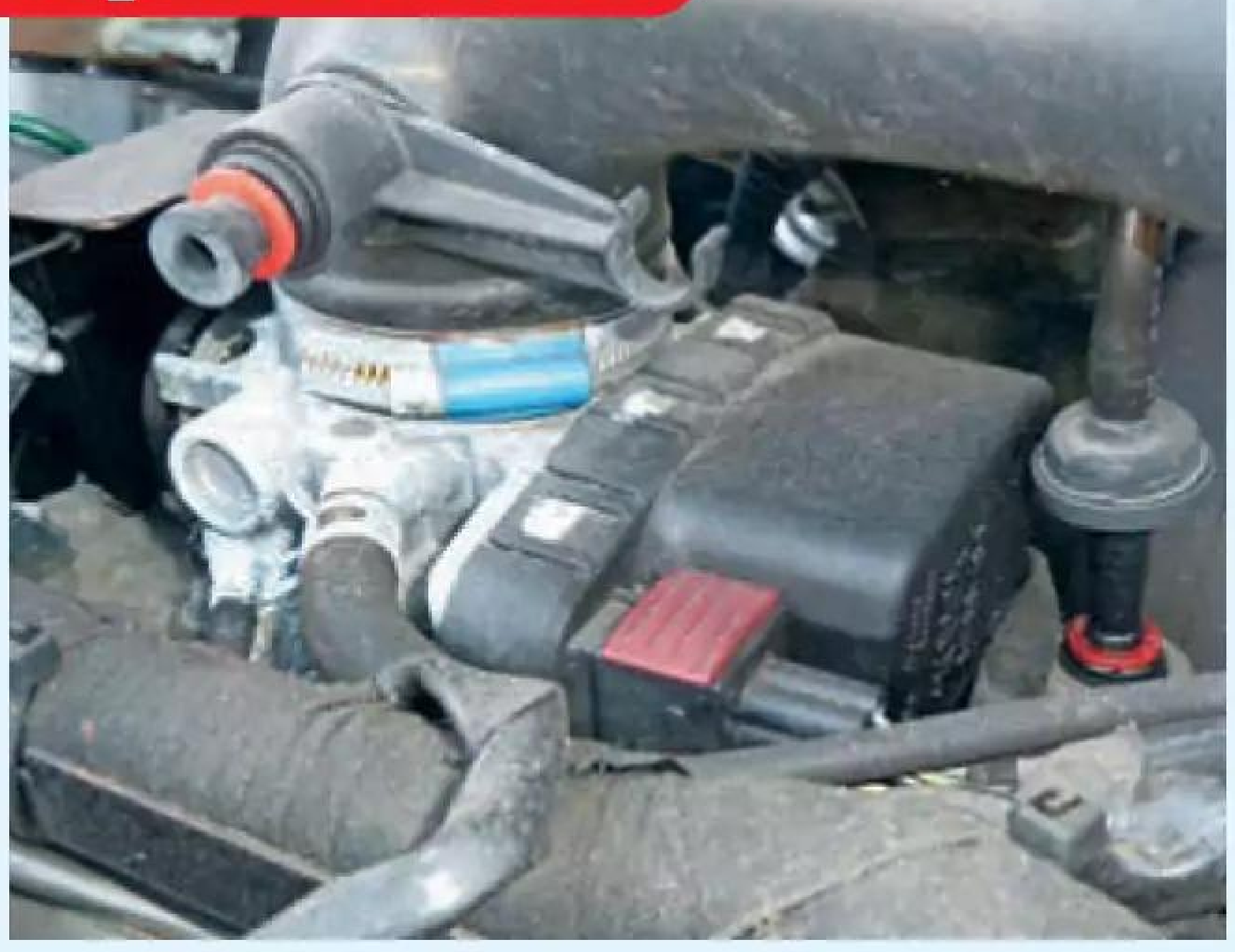
Frequent/regular engine oil changes always pay dividends, but on these engines it is absolutely critical. Always use fully-synthetic oil to the recommended specification.

New turbos are reasonably priced and

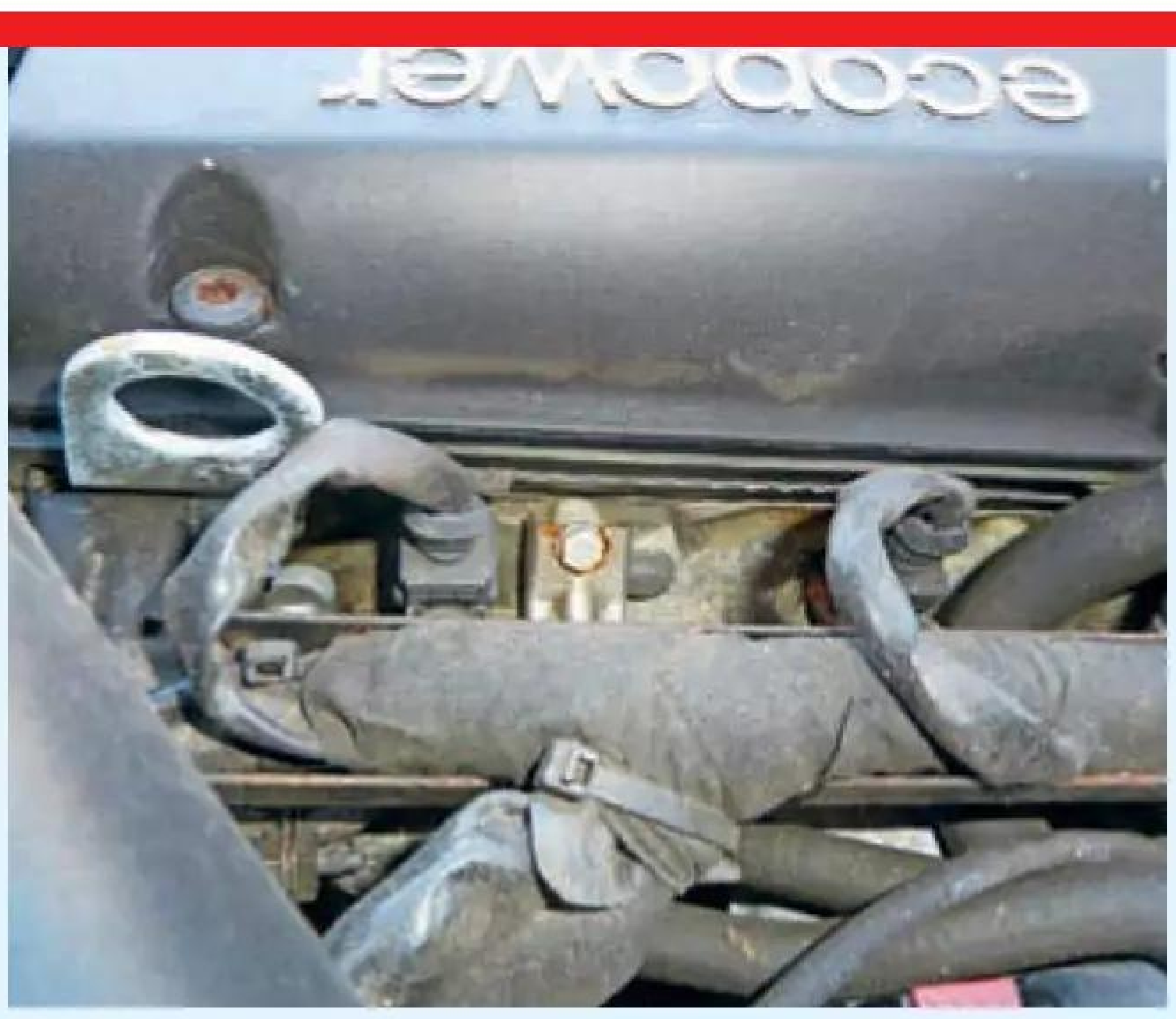
Typical Saab 9-3 components



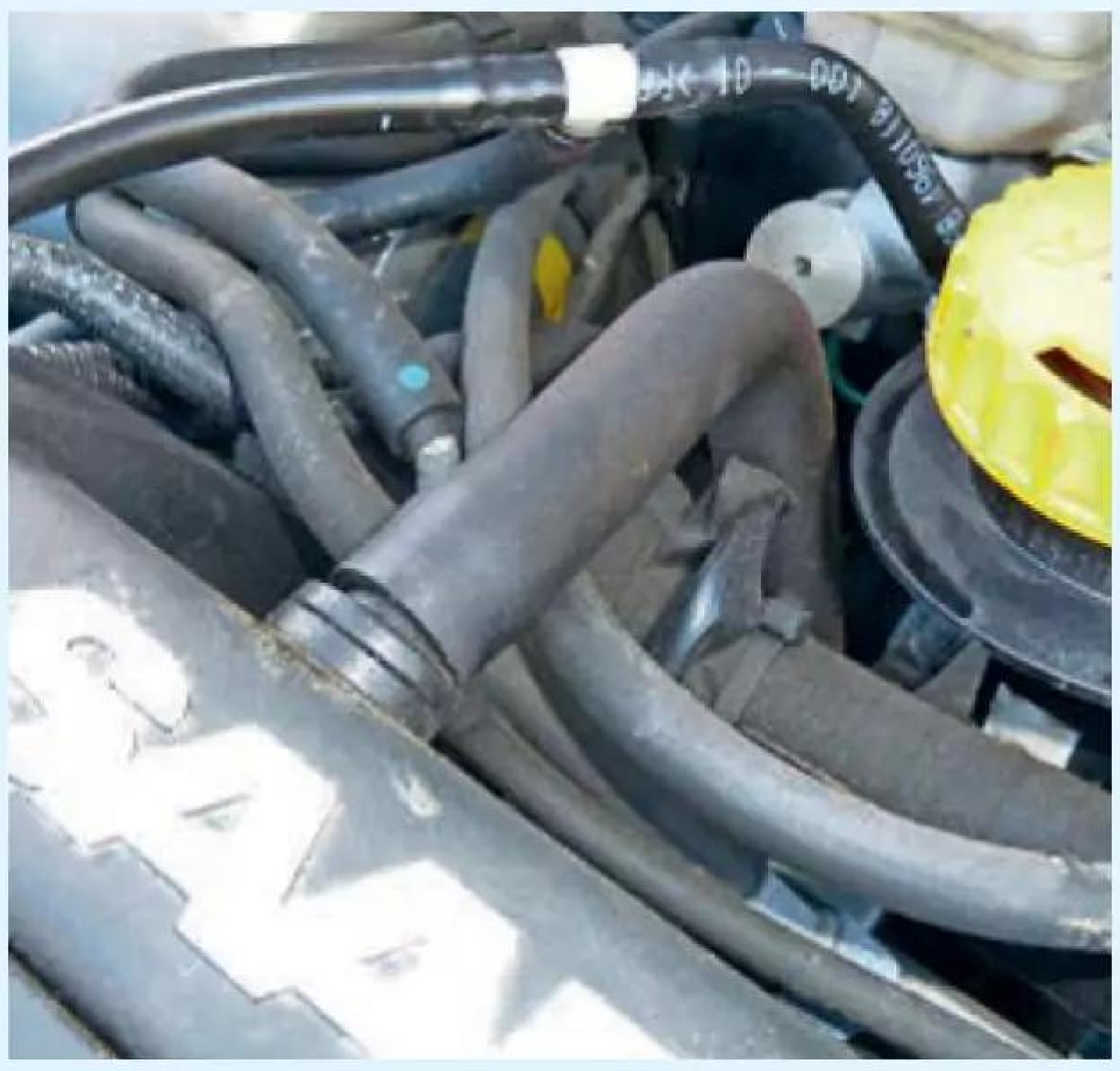
1 To reach the top rear of the engine bay, it is necessary to release the plastic cover panel surrounding the oil filler cap. The direct ignition system coils serving each individual spark plug are located beneath the central cover, secured by four screws.



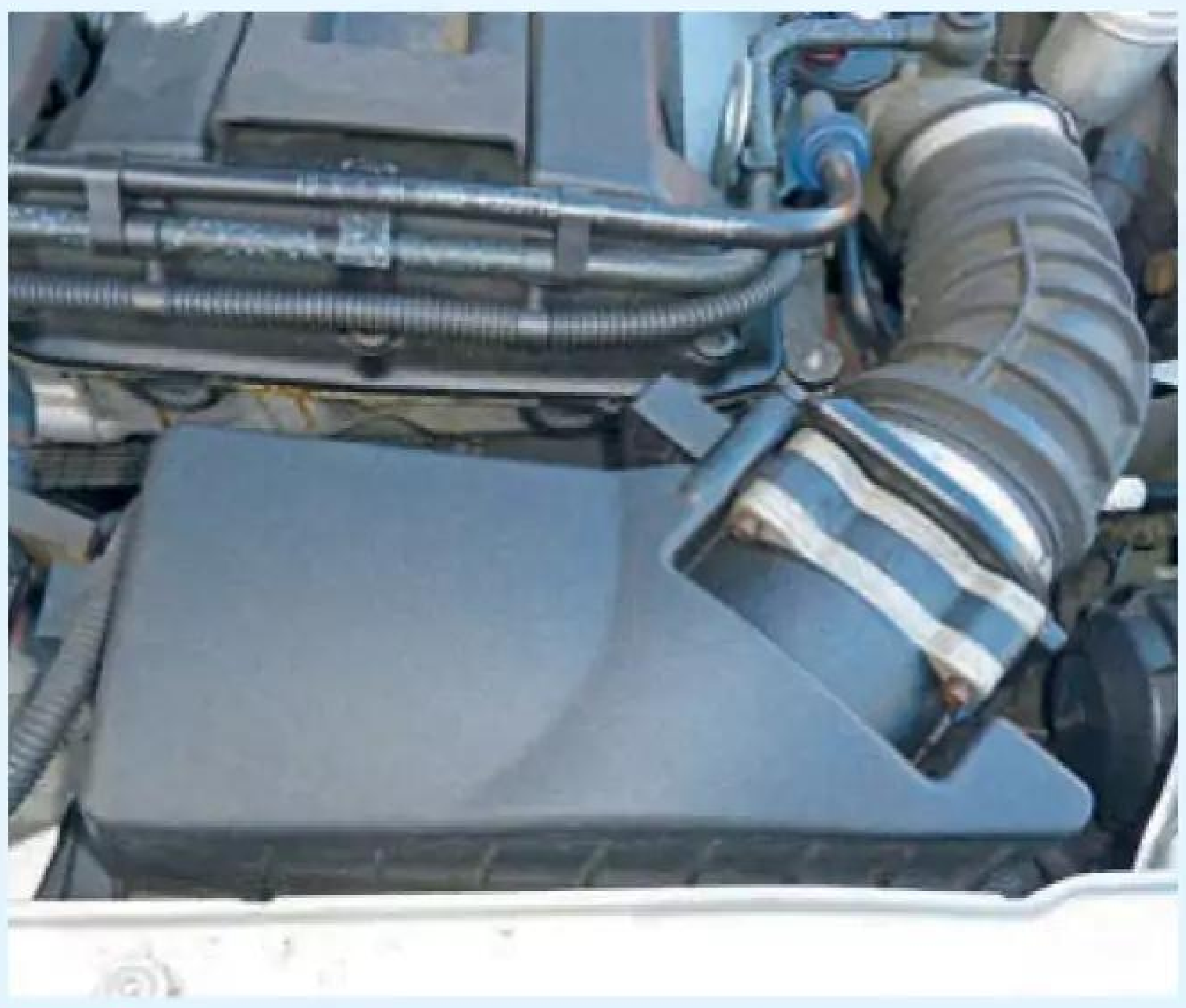
2 The throttle body assembly is at the rear of the engine bay at the top, covered by the plastic cover panel shown in the previous photograph. It is essential that the throttle body and operating plate are kept clean.



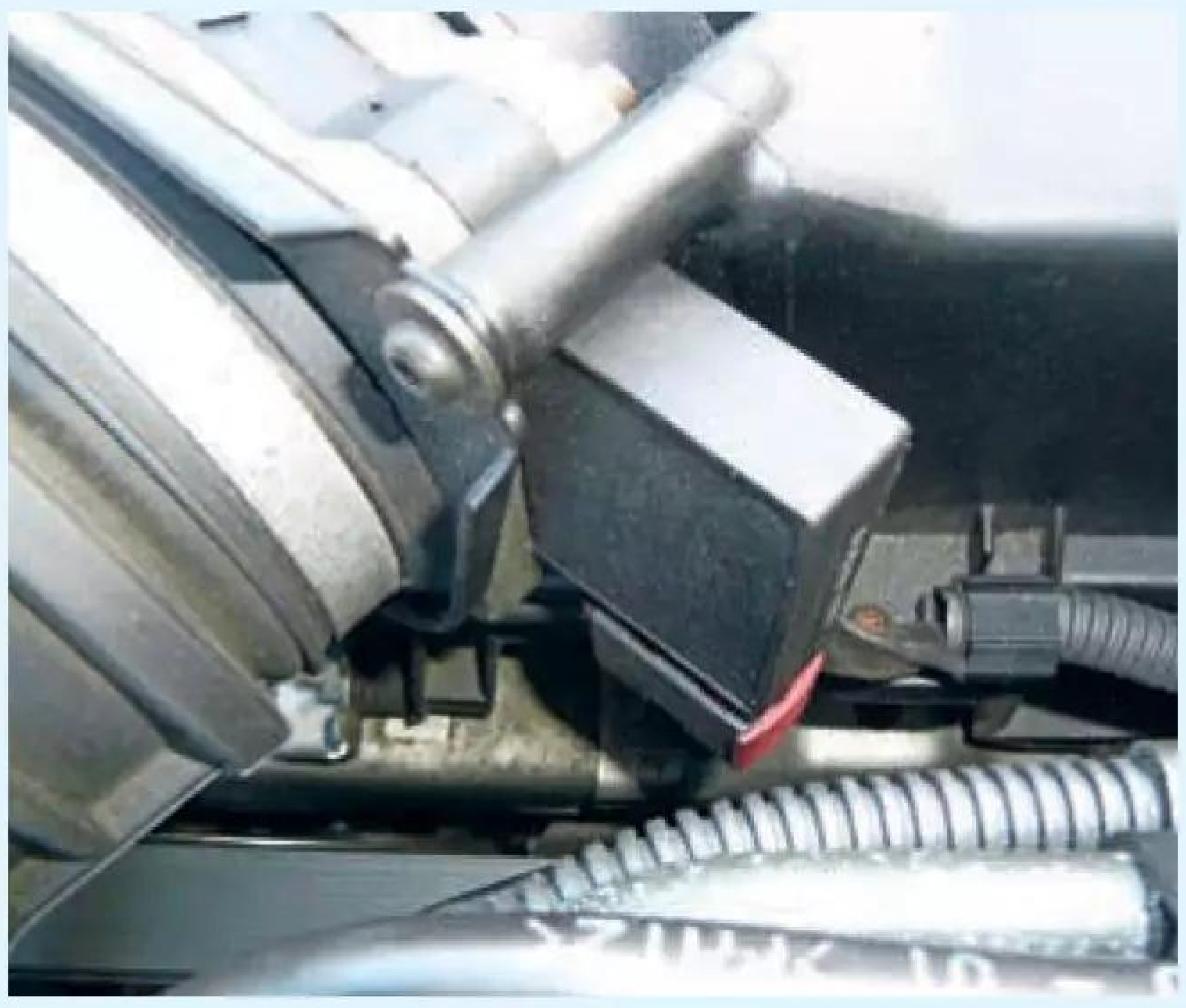
3 The fuel injectors are located adjacent to the fuel rail at the top of the motor, towards the rear of the engine bay. Check for evidence of damaged wiring or connectors. The injectors require clean, high-quality fuel at all times, so pay attention to fuel filter changes.



4 Closely inspect the short length of breather hose connected to the valve cover, which is prone to cracking, resulting in running problems. It is worth inspecting all underbonnet hoses at the same time.



5 The air filter assembly is easy to access in the left-hand front corner of the engine bay. It's essential to renew the air filter element at least as often as recommended by Saab, ideally more frequently. Always use top-quality filters to avoid problems.



6 The mass air flow (MAF) sensor is located in the air intake trunking and monitors the amount of air passing through. This information is relayed to the ECU, enabling the management system to calculate and provide optimum fuelling levels.

easy to fit, but be wary of cheap parts. We recently fitted a customer-supplied turbo to one of these Saabs and, once fitted, the unit was blowing from all the joints, so it ended up being a very expensive fix.

Fault 3

IN-TANK FUEL PUMP

With this fault, the vehicle will present itself as a cranking non-start, with a spark at the coil but no fuel pressure showing. Your first test should be to turn on the ignition and listen for a buzz from the rear indicating that the fuel pump is running. If no buzzing can be heard, locate the 15-amp fuse number F37 within the fusebox inside the vehicle and you will possibly find it has blown. Renew the fuse and it's likely the vehicle will start, but remember that a fuse doesn't usually just blow without a reason.

Renewing the fuse and using an amp clamp will show 11+ amps. The fuse rating is 15 amps, so this is an indication of a high-current draw taking place, indicating the fuel pump windings are failing. Renewing the fuel pump is a simple case of lifting the back seats and replacing the pump and sender. Always replace the rubber seal to ensure a tight and leak-free fit. If no special tool is available, a large screwdriver/punch can be used to secure the assembly, but be very gentle as the unit is only made of plastic and is fragile.

Technical Specs

Actual values

Component	Value
Fuel injectors	16 ohms
Crankshaft sensor	770-950 ohms
MAF sensor	Ignition-on signal 5 volts
Oxygen sensor heater circuit	9 ohms
Coolant temperature sensor	
@ 20°C	2100-2900 ohms
@ 80°C	295-365 ohms

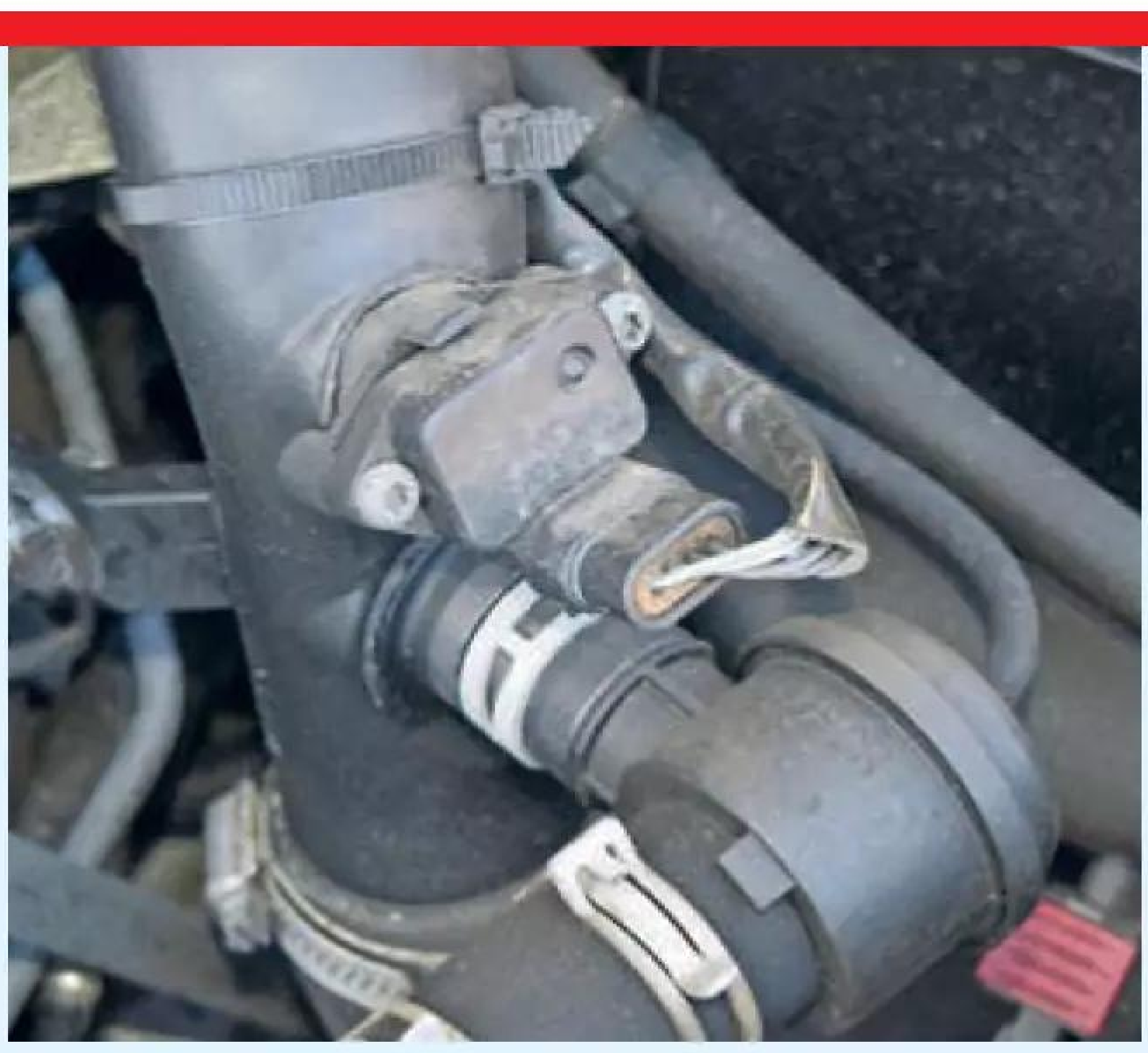
Fault 4

BULKHEAD CRACKING

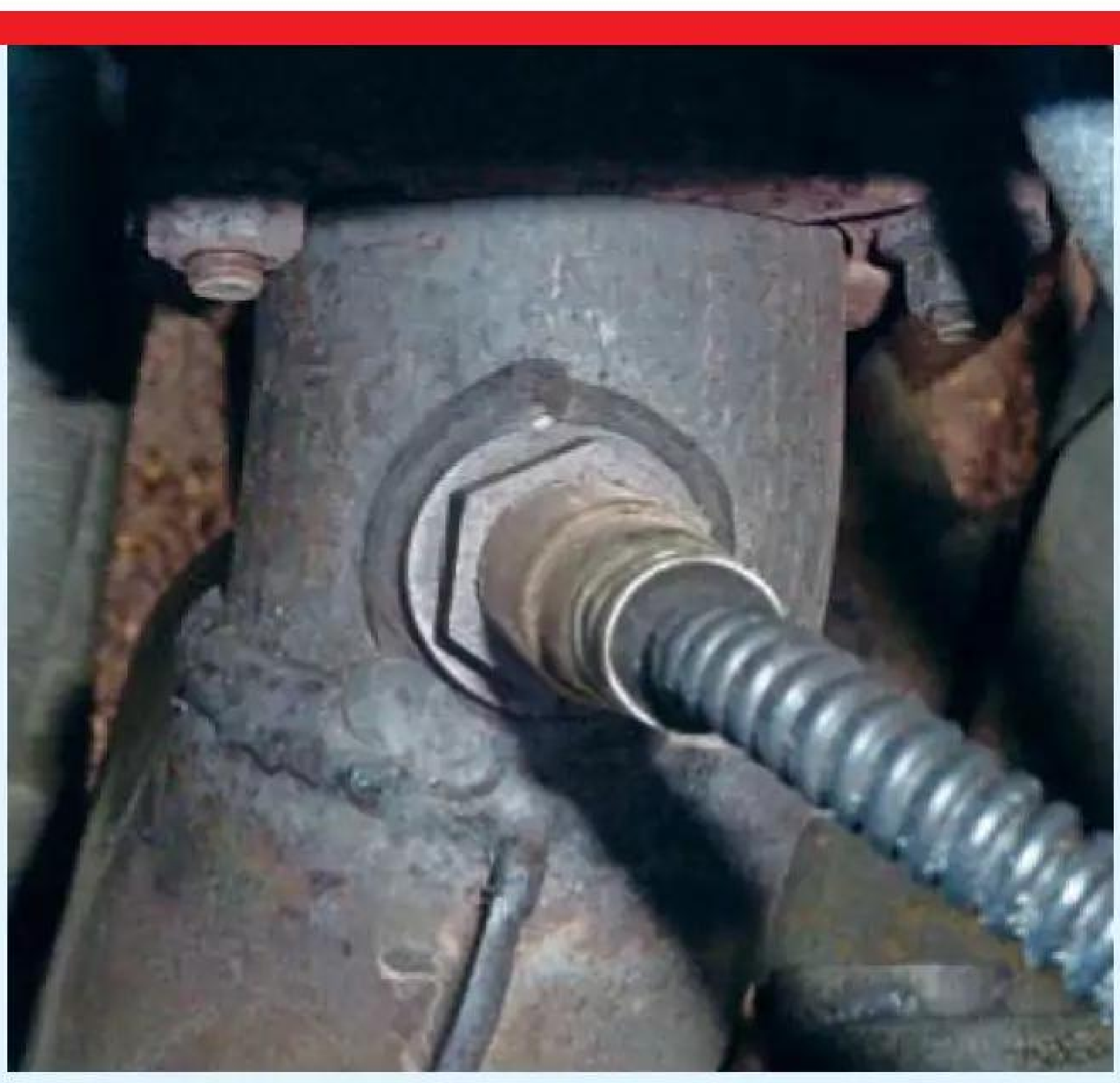
Symptoms of our fourth fault can be quite alarming, with the steering feeling loose and uncertain. This could be down to a worn balljoint, but could be much more serious and expensive to rectify. For two recent 9-3s suffering from this affliction, the cost of repairs exceeded the value of the vehicles, writing them off.

The problem may be due to cracking/splitting of the bulkhead in the vicinity of the steering rack – essentially, the rack parts company with the bulkhead. One check is to try turning the steering wheel with the car stationary and, if the pedals move, it indicates a cracked bulkhead.

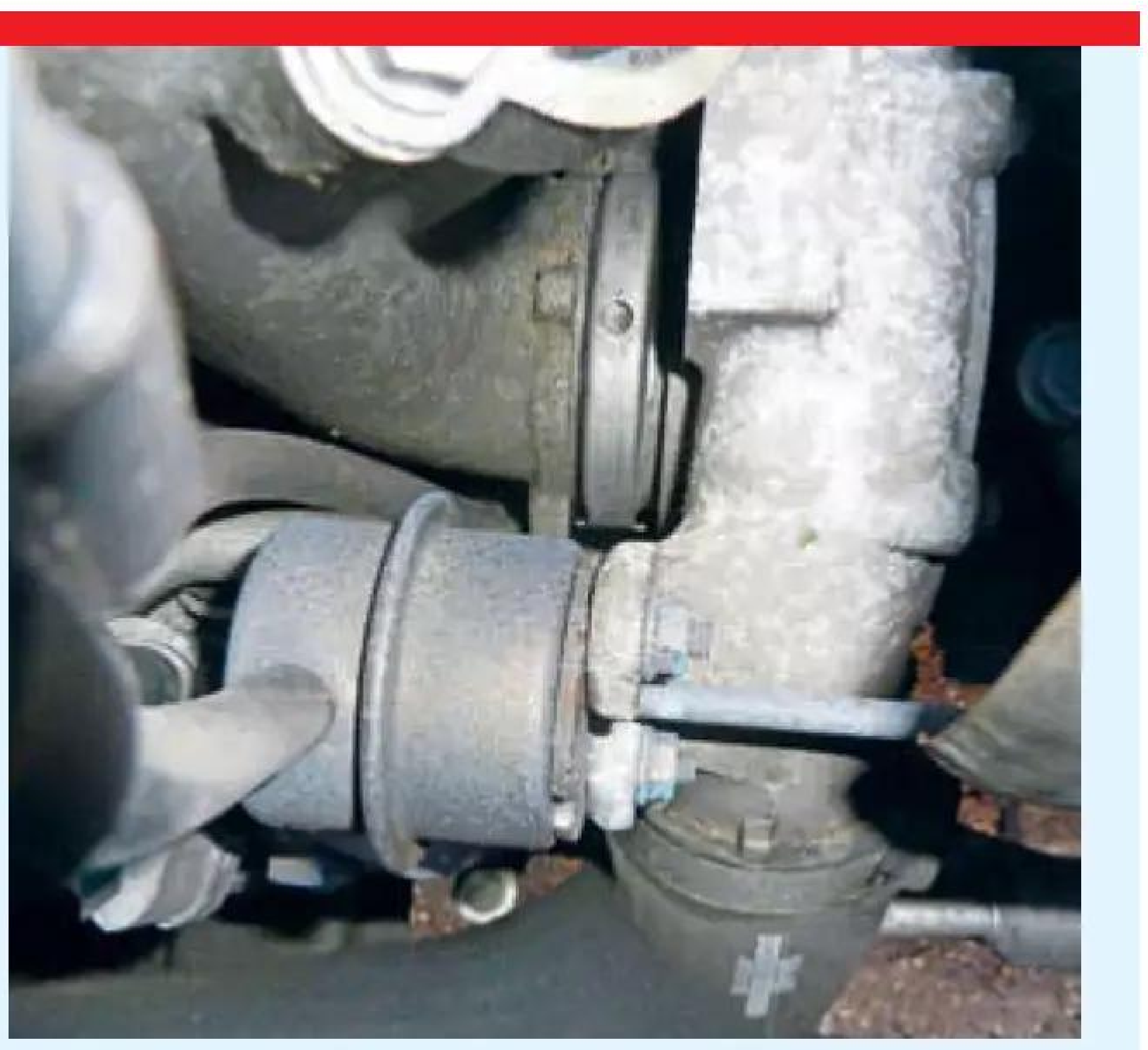
Repair kits are available to strengthen the bulkhead and prevent the cracking from occurring. These are available online for around £55, but we understand that the quality can vary. If the bulkhead has already cracked, rectification is a major job and can cost several hundred pounds.



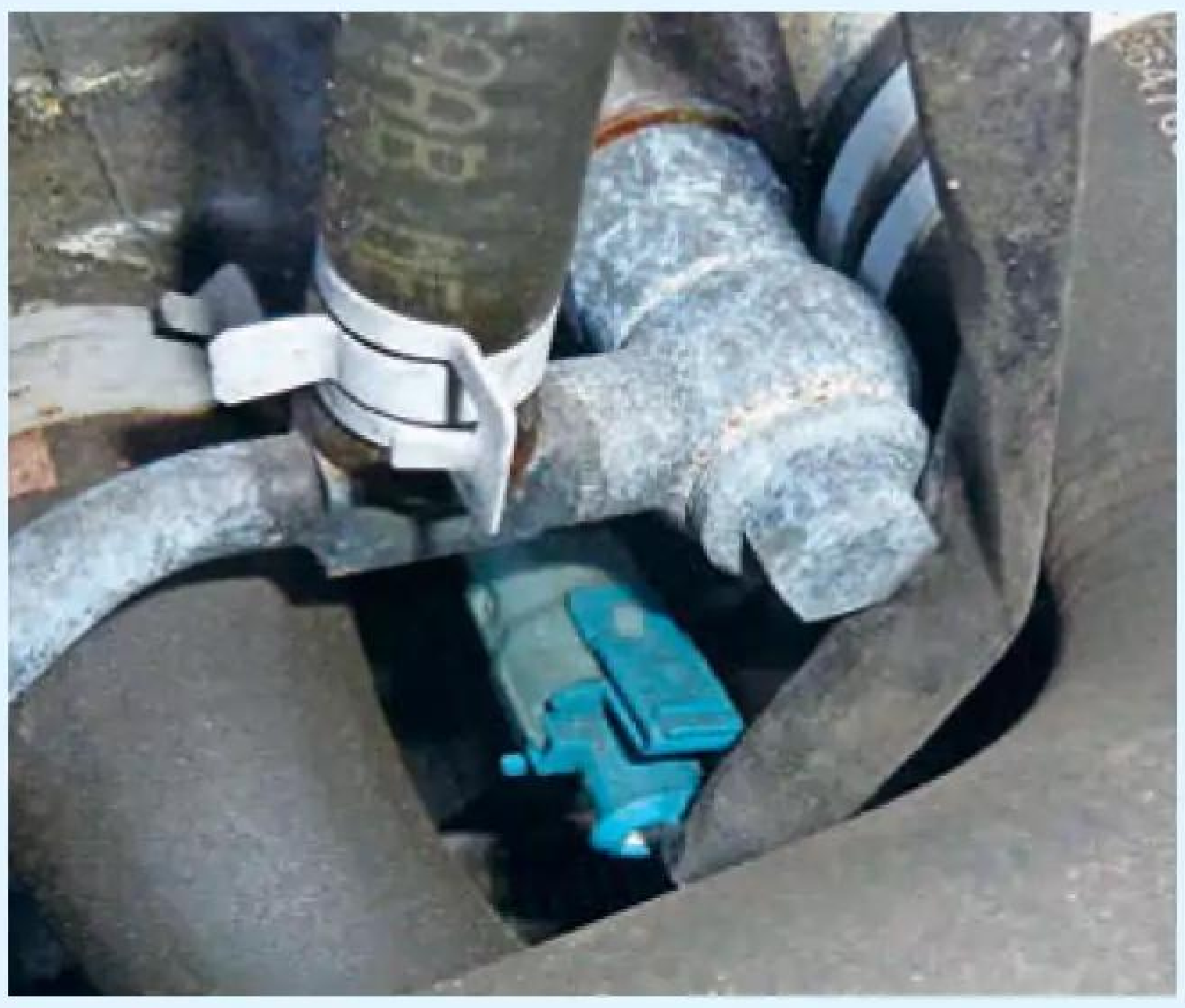
7 **The mass absolute pressure (MAP) sensor is a vital component for ensuring the correct air/fuel ratio. Its function is to supply the ECU with data relating to the pressure within the inlet manifold, aiding the ECU in determining appropriate fuelling.**



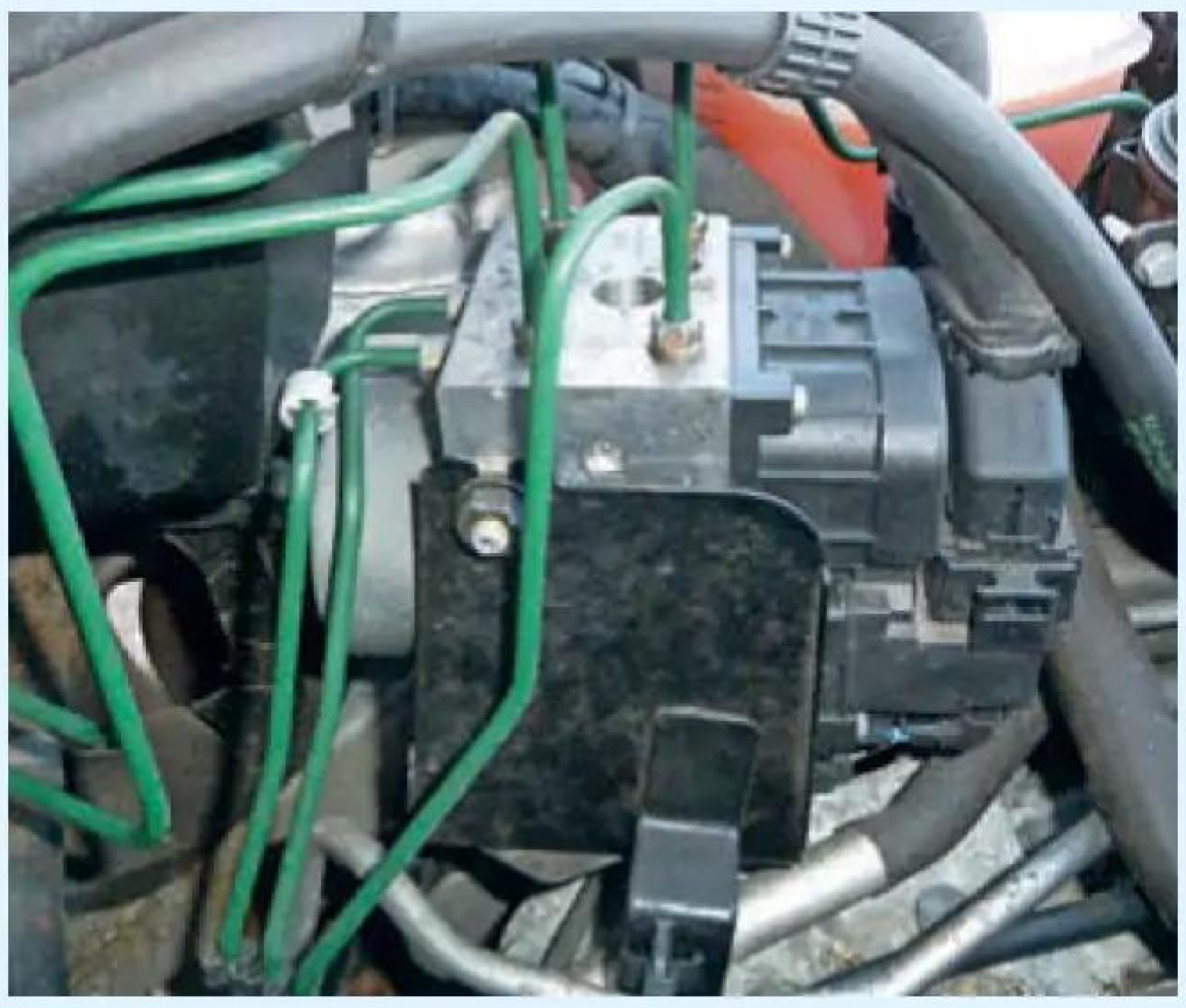
8 **Hidden away low down within the engine compartment is this oxygen/O2/Lambda sensor. Check for component condition and for the integrity of the electrical wiring and connections.**



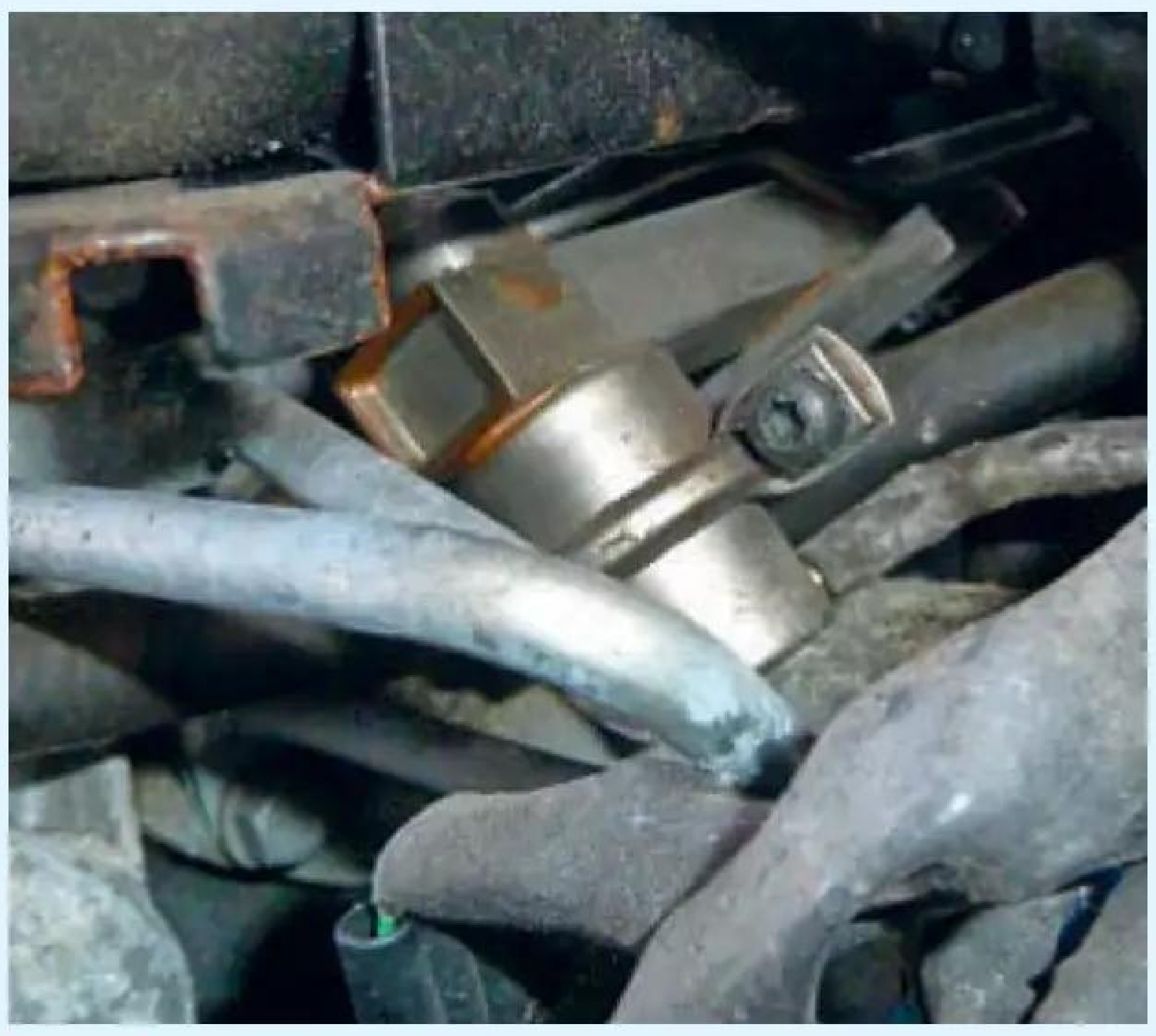
9 **The vitally important turbocharger and actuator are positioned low down within the engine bay. For turbo longevity and correct operation, it's essential you use high-quality engine oil to the correct specification, changed at frequent intervals.**



10 **The blue component is the coolant temperature sensor, attached directly to the left-hand end of the cylinderhead. It reports engine temperature to the ECU as another parameter in fuel supply.**



11 **Positioned towards the left-hand side of the rear engine compartment is the anti-lock brake system (ABS) pump/control unit. Inspect all of the pipework for security and condition.**



12 **Located at the end of the fuel rail, and rather tucked away, is the fuel pressure regulator, which enables fuel at the correct pressure to be delivered to the injectors.**

USEFUL PREPARATION DATA

SERVICE INTERVALS
Every 6000 miles or annually, whichever comes first.

Below are the official recommended change intervals for the various components. We recommend that ideally the service/change intervals are at least halved:

Engine oil and filter Every 6000 miles or 12 months, whichever comes first.

Oil type SAE 0W-30/0W-40 fully-synthetic to specification GM-LL-025.

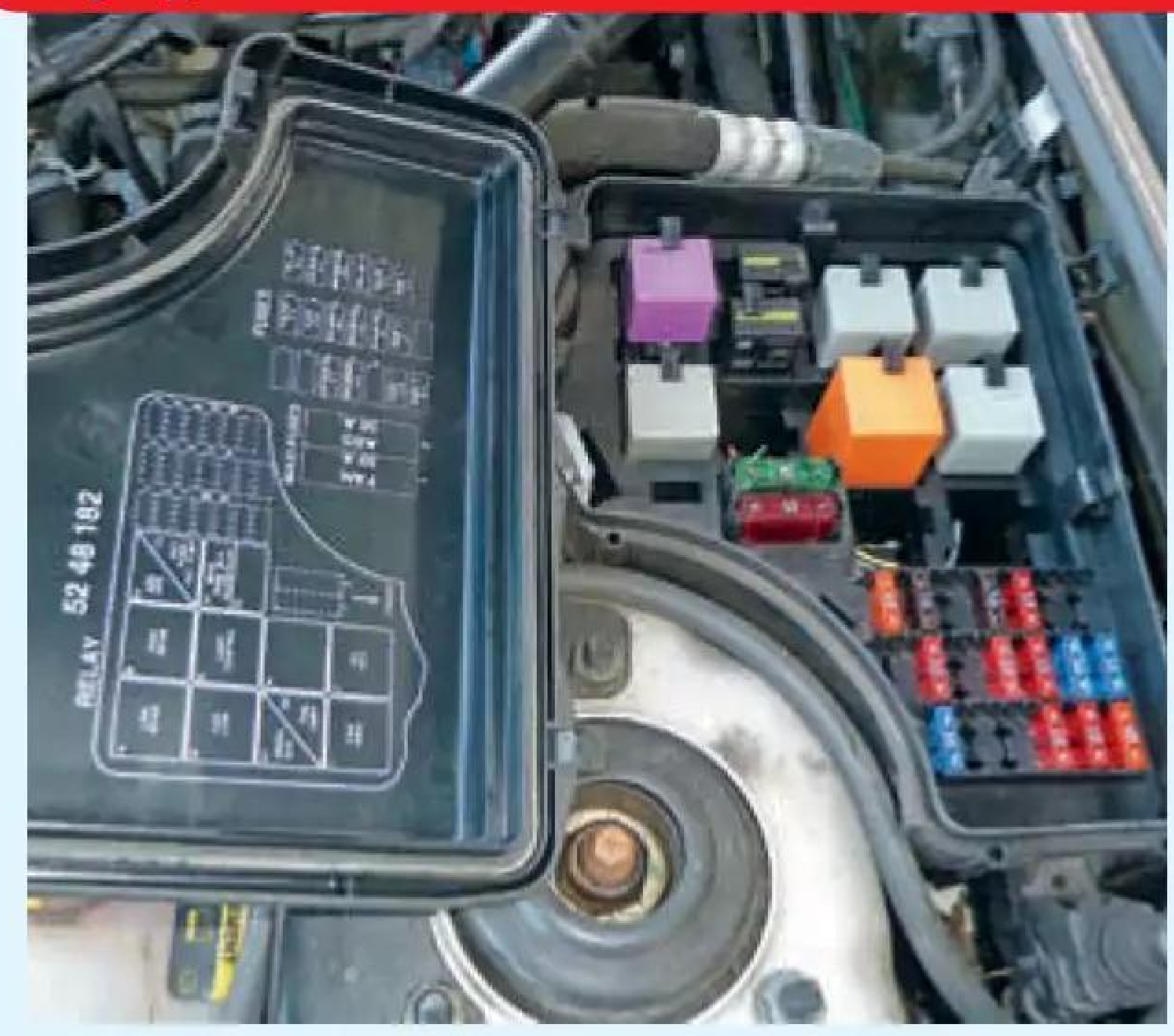
Capacity (service fill) Four litres. **Oil filter torque setting** Hand-tight. **Sump plug torque setting** 25Nm.

Air filter Every 30,000 miles or 36 months. **Spark plugs** Every 30,000 miles or 36 months; use NGK BCPR6ES-11 plugs or equivalent.

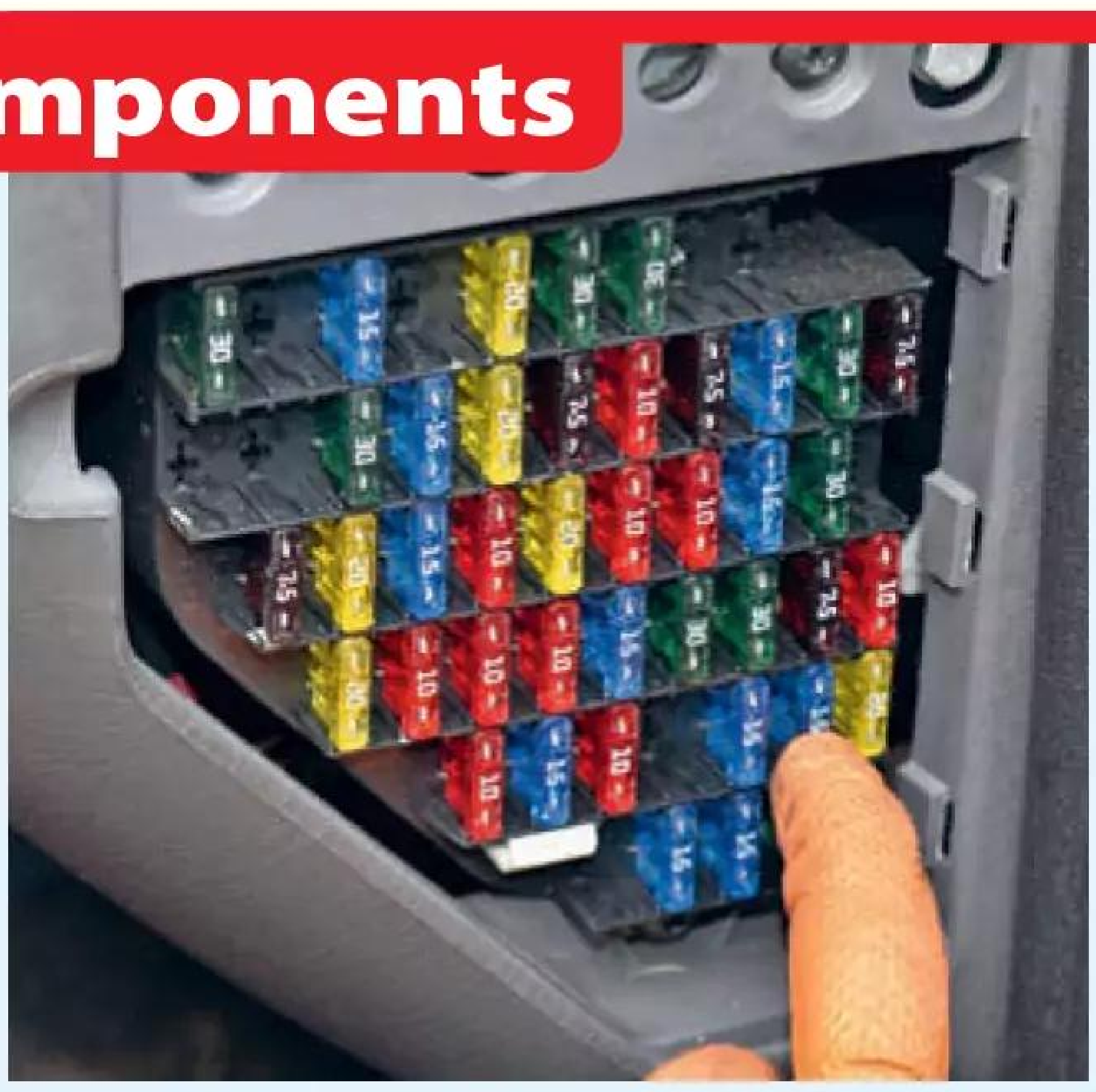
Cam/timing chain There is no routine renewal interval, but you will need these Saab special tools to change the chain:

- Flywheel/drive plate locking tool (part no 83 94 868).
- Timing chain link separator (part no 83 94 637).
- Timing chain link installer 1 (part no 83 94 660).
- Timing chain link installer 2 (part no 83 94 652).

Typical Saab 9-3 components



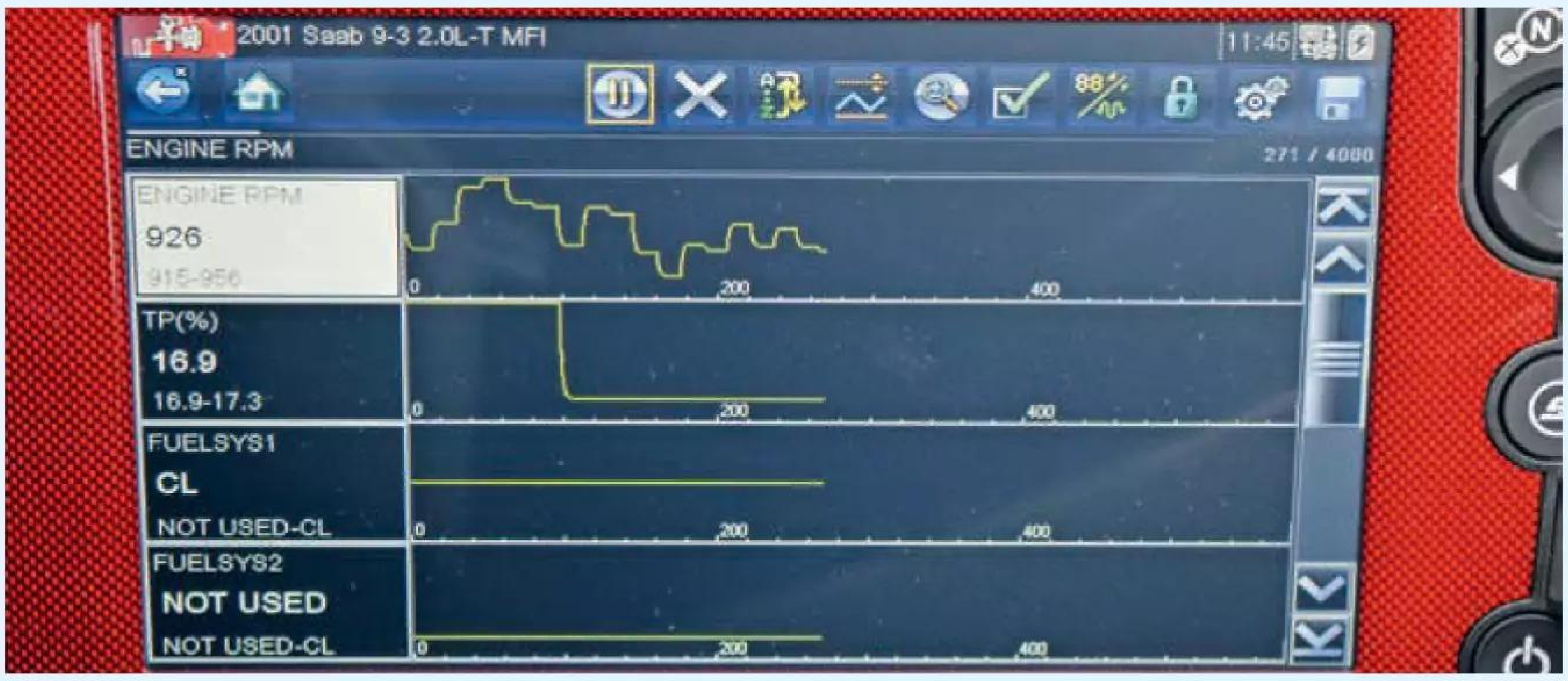
13 Nestling adjacent to the left-hand front suspension turret is the underbonnet fuse and relay box. The positions and ratings of the components within are clearly marked on its lid.



14 The in-car fusebox is positioned at the right-hand end of the fascia assembly and is normally covered by a plastic protective panel. Here, we are pointing out the 15-amp fuse serving the fuel pump.

15 The wiring to the in-tank fuel pump is accessible after lifting the base of the rear seat and removing the plastic panel that protects the wiring and connector plug/socket. Ensure that the cables and connections are in good condition and securely attached.

16 In common with other contemporary Saab models, the 9-3 ignition/lock assembly is located on the centre console, between the front seats and just ahead of the handbrake lever.

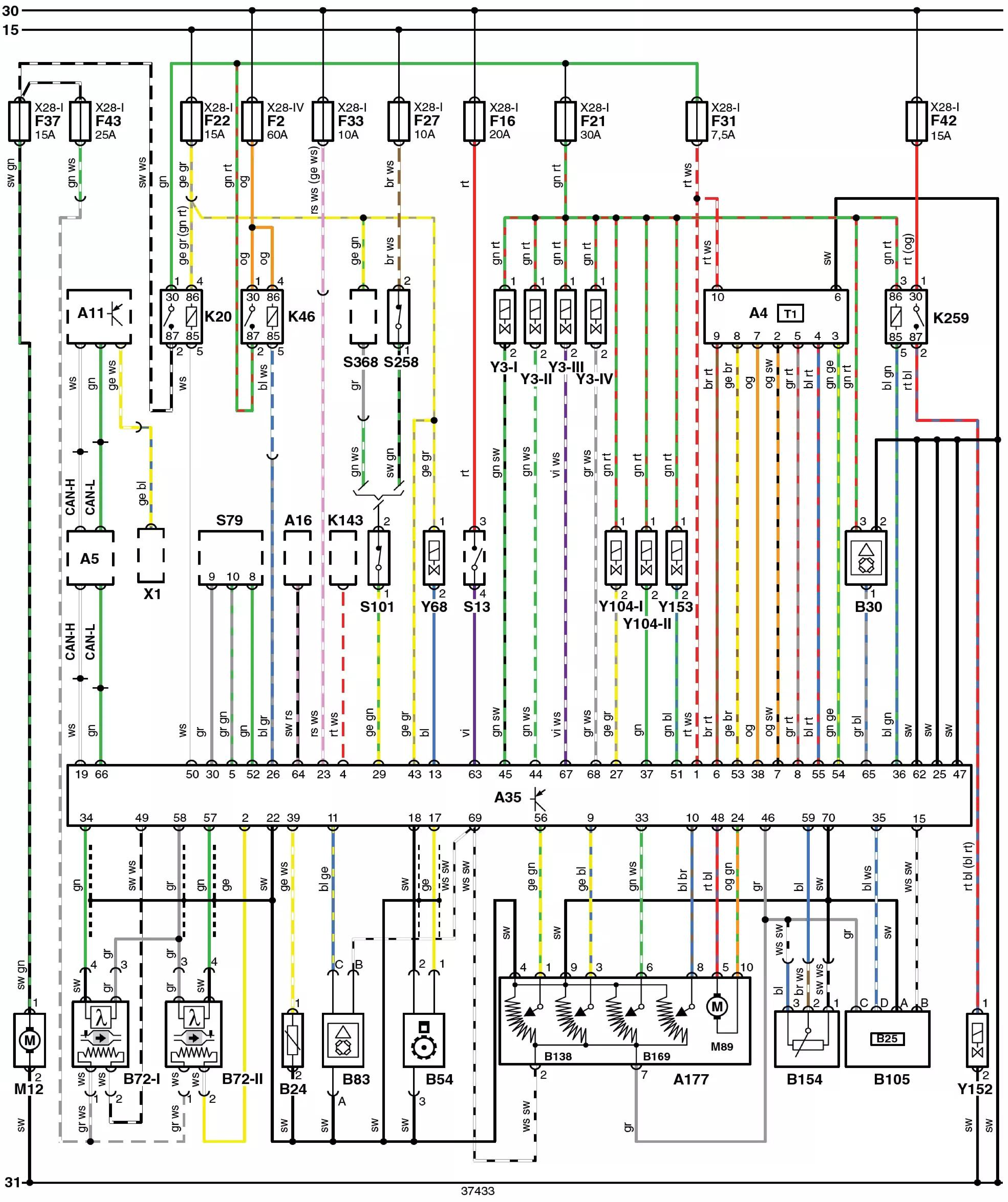


2001 Saab 9-3 2.0L-T MFI
11:45
ENGINE RPM
271 / 4000
ENGINE RPM
926
915-956
TP(%)
16.9
16.9-17.3
FUELSYS1
CL
NOT USED-CL
FUELSYS2
NOT USED
NOT USED-CL

17 One of the positive aspects of the SOLUS Edge is that it can be set up to show live data. This screenshot relates to engine speed and associated information.

CODE	COMPONENT DESCRIPTION
A4	IGNITION CONTROL MODULE (ICM)
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A16	ABS CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A177	THROTTLE CONTROL UNIT
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B72-I	HEATED OXYGEN SENSOR (HO2S) | **1**
B72-II	HEATED OXYGEN SENSOR (HO2S) | **2**
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B154	EVAPORATIVE EMISSION (EVAP) PRESSURE SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
F	FUSE
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
K259	LIMP-HOME SOLENOID RELAY
M12	FUEL PUMP (FP)
M89	THROTTLE MOTOR
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S79	CRUISE CONTROL MASTER SWITCH
S101	CRUISE CONTROL BRAKE PEDAL SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S368	TRANSMISSION GEAR POSITION SWITCH
T1	IGNITION COIL

TRIONIC T7 CIRCUIT DIAGRAM


30
15
31
X28-I F37 15A
X28-I F43 25A
X28-I F22 15A
X28-IV F2 60A
X28-I F33 10A
X28-I F27 10A
X28-I F16 20A
X28-I F21 30A
X28-I F31 7,5A
X28-I F42 15A
A11
K20
K46
S368
S258
Y3-I
Y3-II
Y3-III
Y3-IV
A4
T1
K259
CAN-H
CAN-L
A5
X1
S79
A16
K143
S101
Y68
S13
Y104-I
Y104-II
Y153
B30
A35
M12
B72-I
B72-II
B24
B83
B54
B138
B169
M89
A177
B154
B105
B25
Y152
37433

CODE	COMPONENT DESCRIPTION
X1	DATA LINK CONNECTOR (DLC)
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4

CODE	COMPONENT DESCRIPTION
Y68	TURBOCHARGER (TC) WASTEGATE REGULATING VALVE
Y104-I	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE | 1
Y104-II	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE | 2

CODE	COMPONENT DESCRIPTION
Y152	LIMP-HOME SOLENOID
Y153	TURBOCHARGER (TC) INTAKE DIVERT VALVE
15	IGNITION SWITCH – IGNITION ON
30	BATTERY +
31	BATTERY –

Electronic Diagnostics

JAGUAR X300 3.2

Tracing and fixing faults in electronic engine management systems

We're investigating the Jaguar X300. This was a pioneering model in its time, so **Kim Henson** and **Edward Haggar** take a close look beneath the surface.

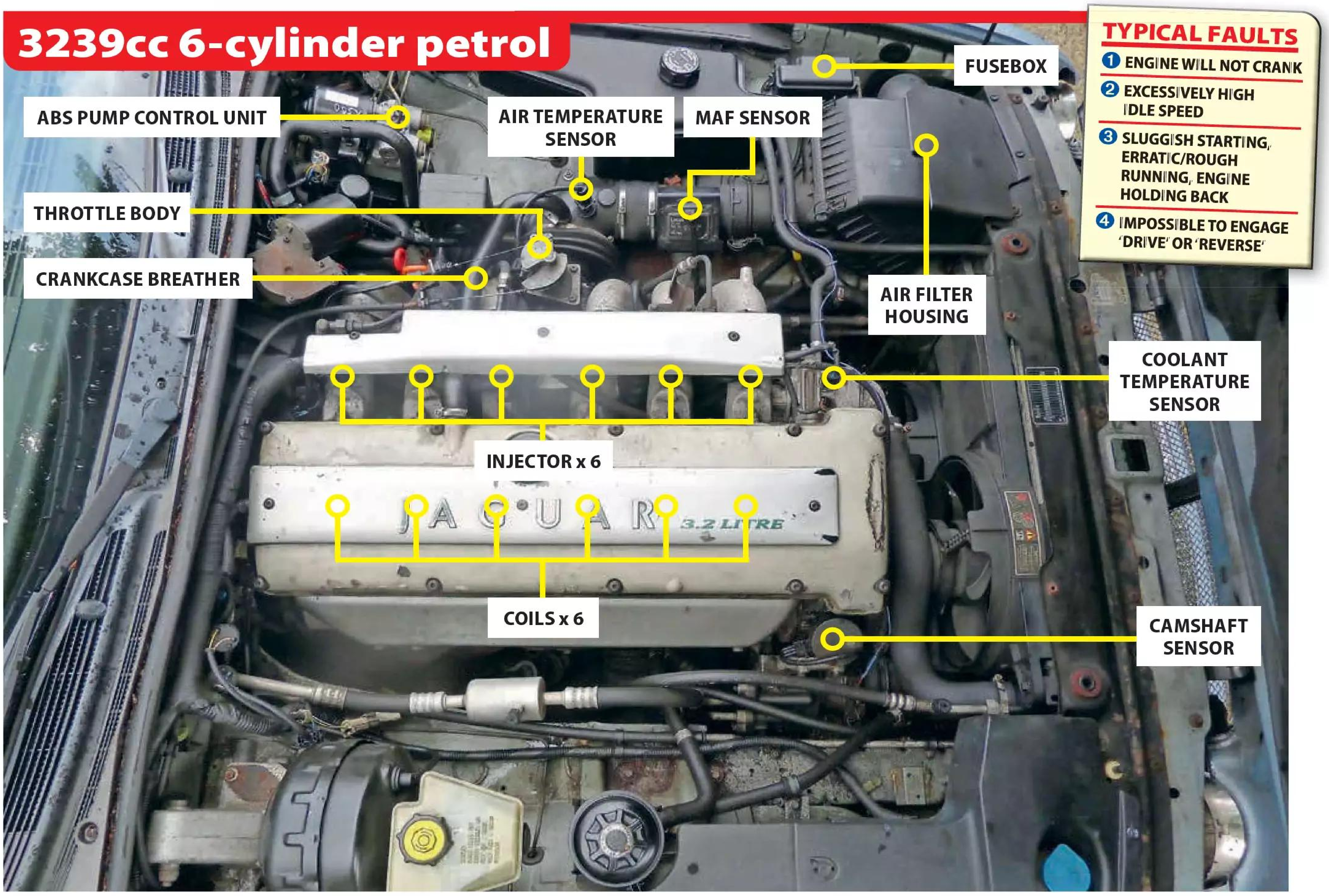
The X300 was the first Jaguar to result from Ford's involvement and was a development of the XJ40 series (itself evolved from the XJ models produced from 1968 onwards). Much attention was paid to ensuring reliability and quality, as well as to its dynamic abilities. The X300 was widely praised for its excellent performance, handling, ride comfort, fuel consumption and interior ambience, and was hailed as one of the best luxury saloons of its time.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Under the bonnet was a straight-six engine (AJ16) offered in 3.2- and 4.0-litre versions, both with electronic engine management. Although not the subject of this article, a V12 version was also sold, along with the supercharged six-cylinder XJR. The X300 was produced until 1997, then replaced by V8-powered variants (X308) on a similarly-styled theme.

The X300 bristled with electronic control systems and inter-related wiring, fuseboxes and relays. An indication of the sheer complexity of the vehicle is that the official Jaguar Vehicle Service Manual runs to nearly 1500 pages! If you own an X300, it is worth obtaining one of these,

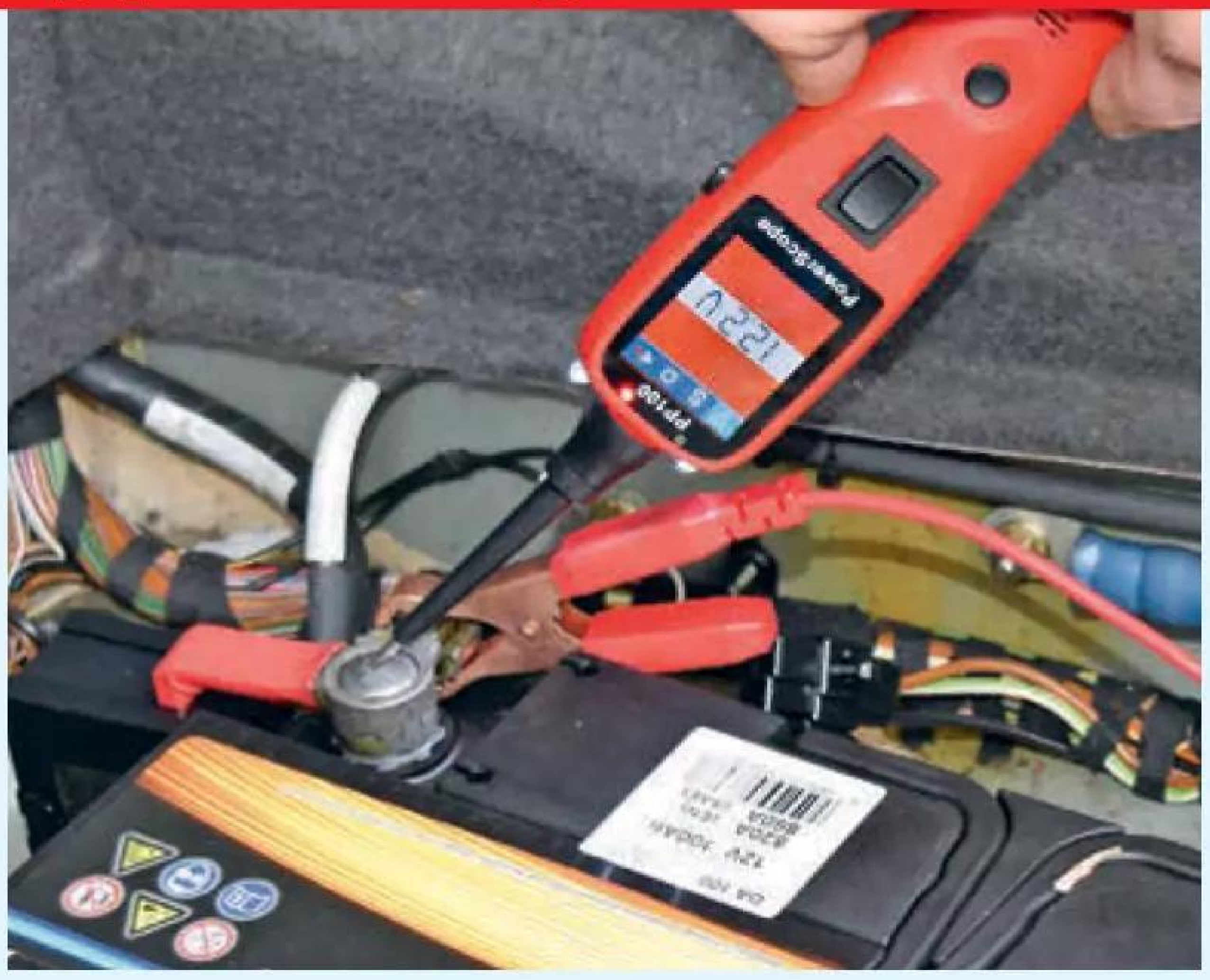
3239cc 6-cylinder petrol



TYPICAL FAULTS

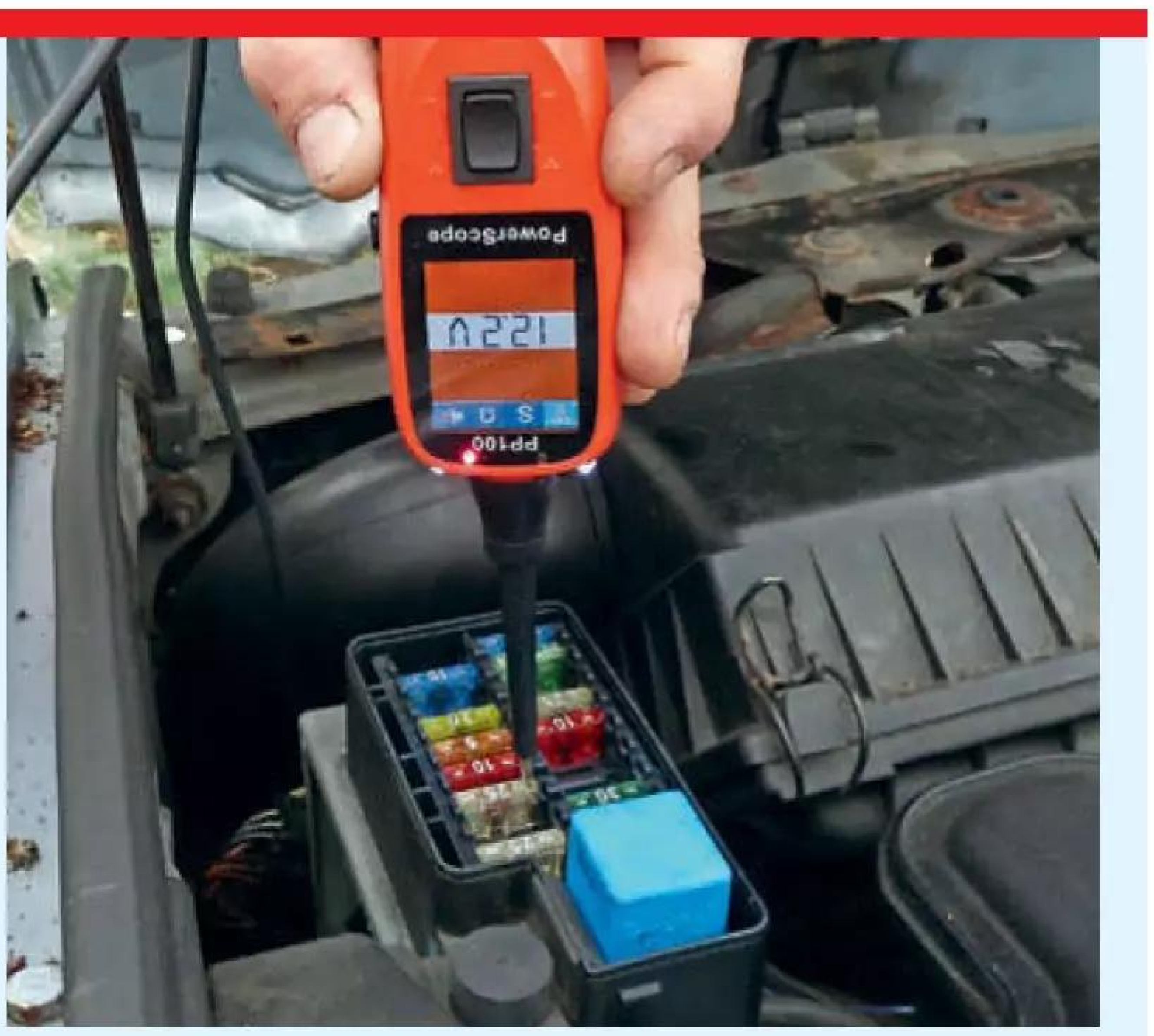
1. ENGINE WILL NOT CRANK
2. EXCESSIVELY HIGH IDLE SPEED
3. SLUGGISH STARTING, ERRATIC/ROUGH RUNNING, ENGINE HOLDING BACK
4. IMPOSSIBLE TO ENGAGE 'DRIVE' OR 'REVERSE'

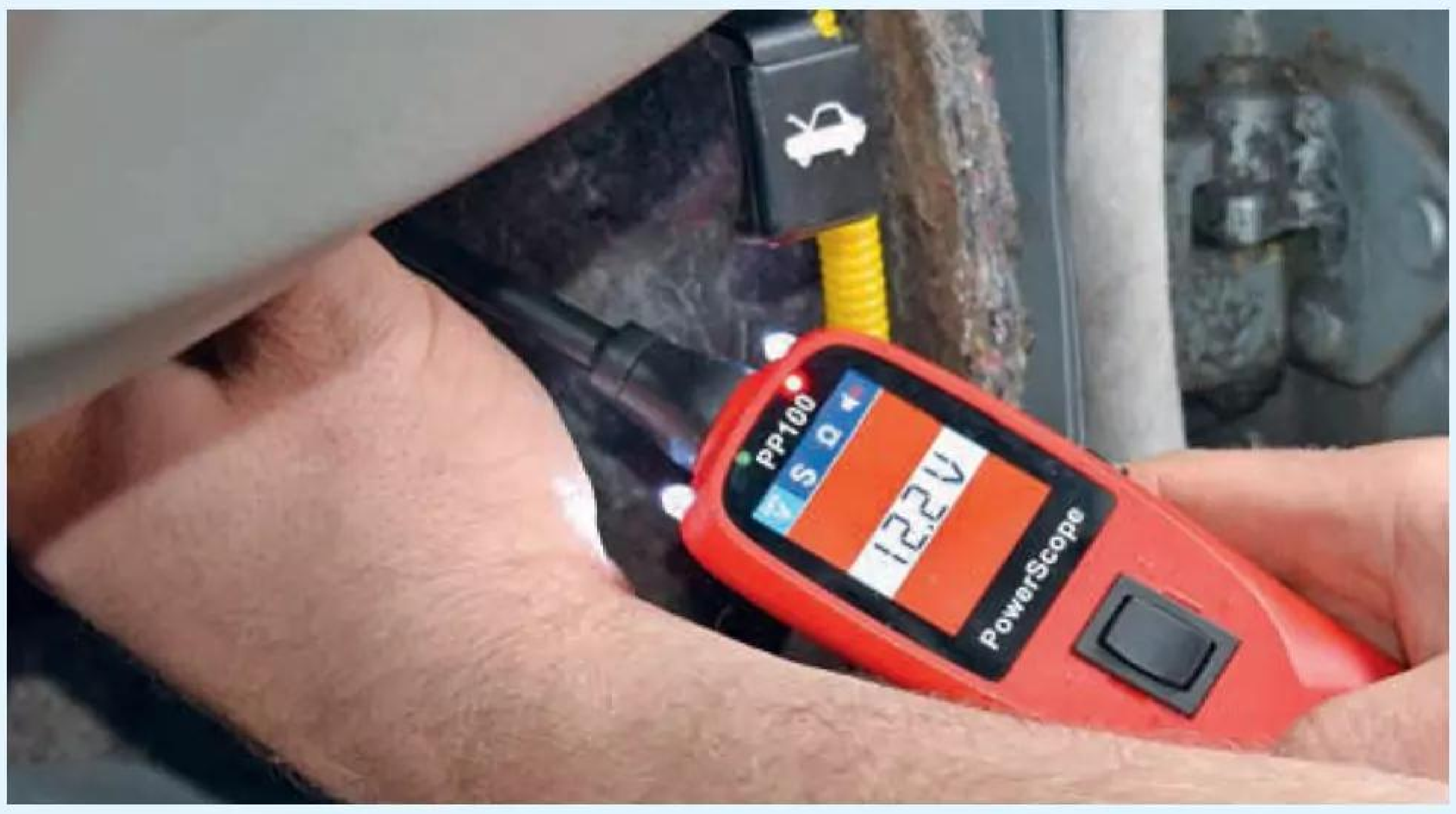
Typical Jaguar X300 components



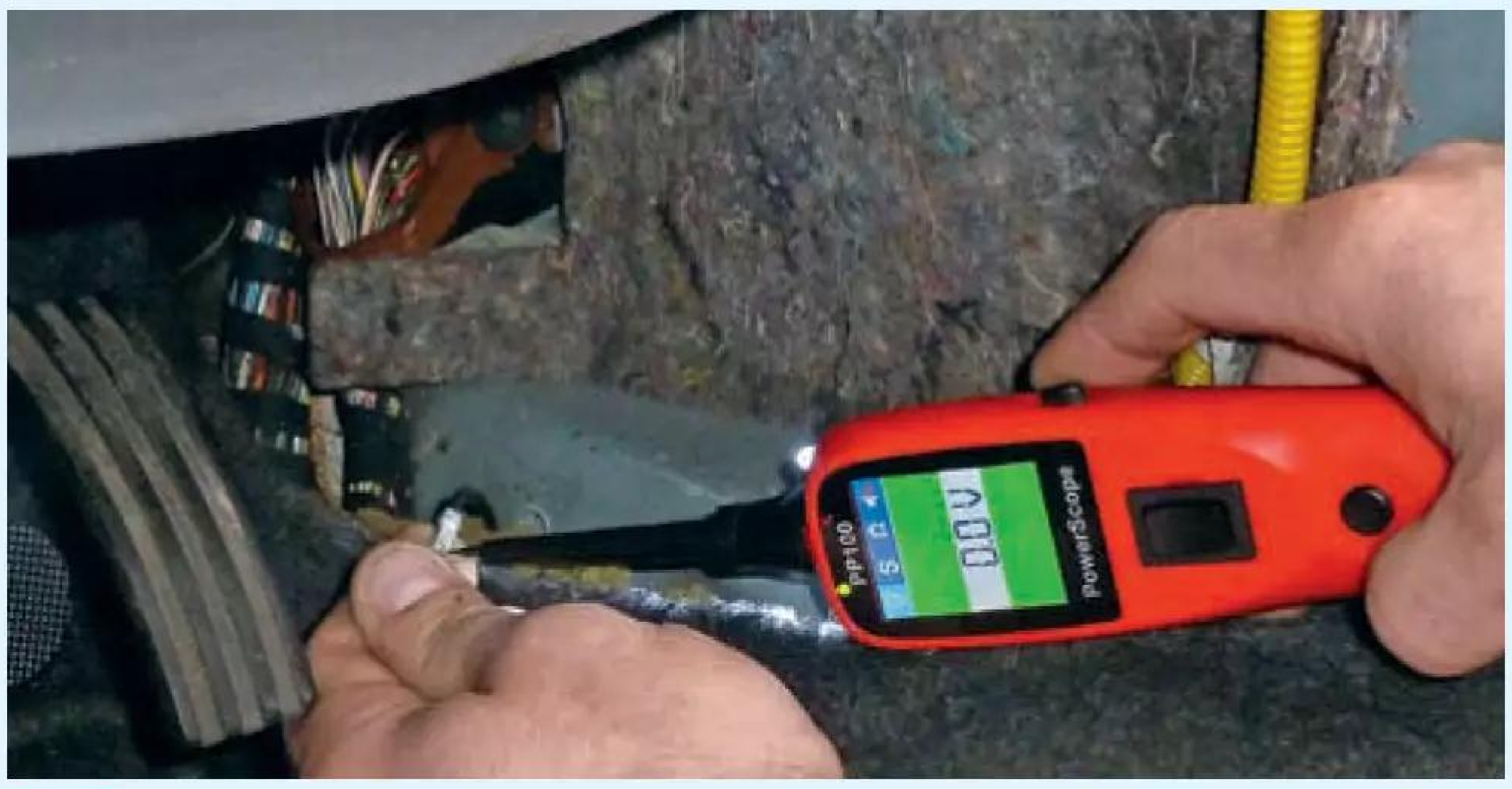
1 ◀ Having a battery of the correct specification, in good condition and fully charged, is essential for reliable running of an X300, so check battery condition and available voltage.

2 ▶ There are a multitude of cable connectors, fuse and relay boxes. Circuit non-operation – including the starter motor – could simply be due to a dirty or broken connection or a failed fuse. Checking for available voltage is a good move.

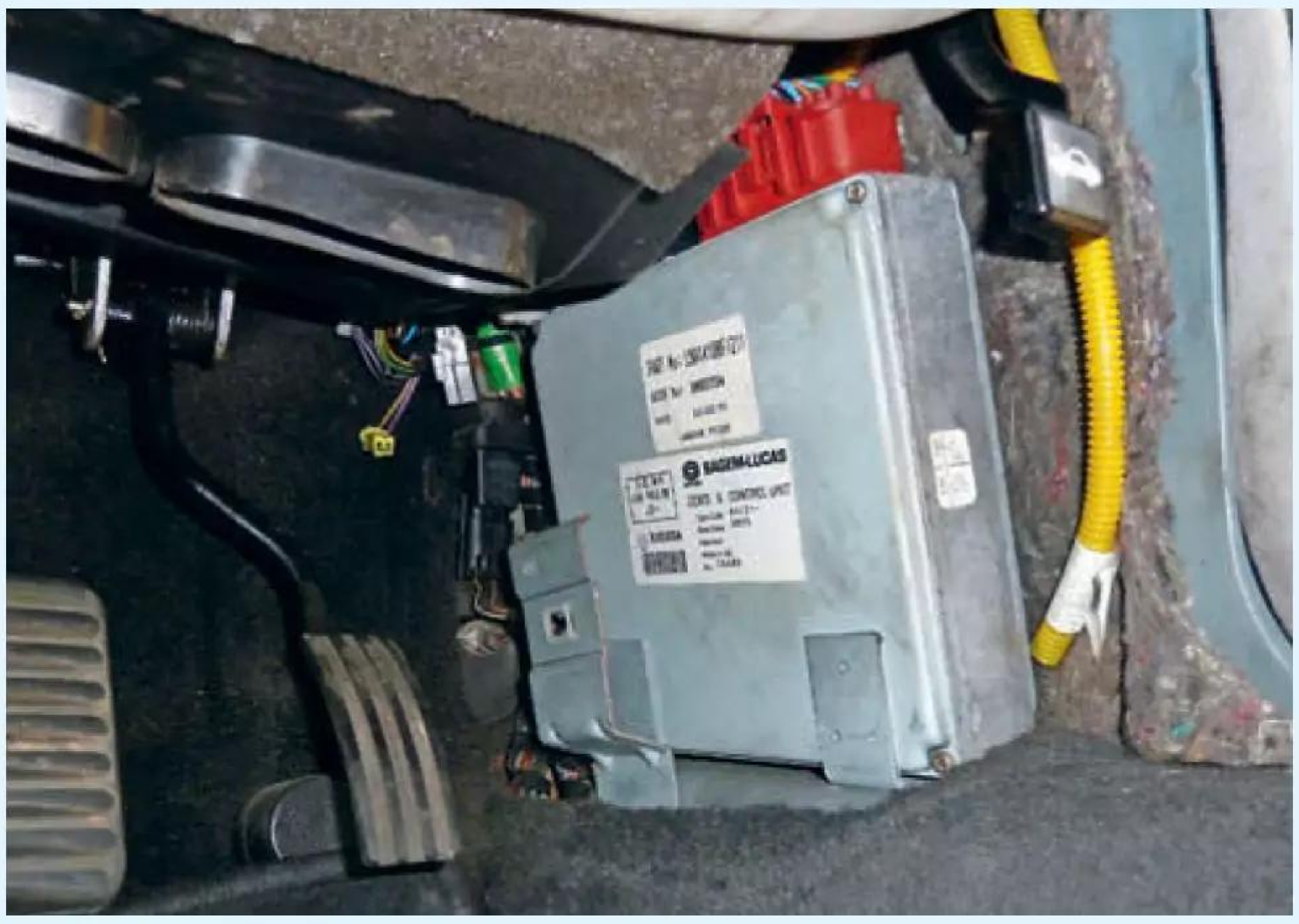




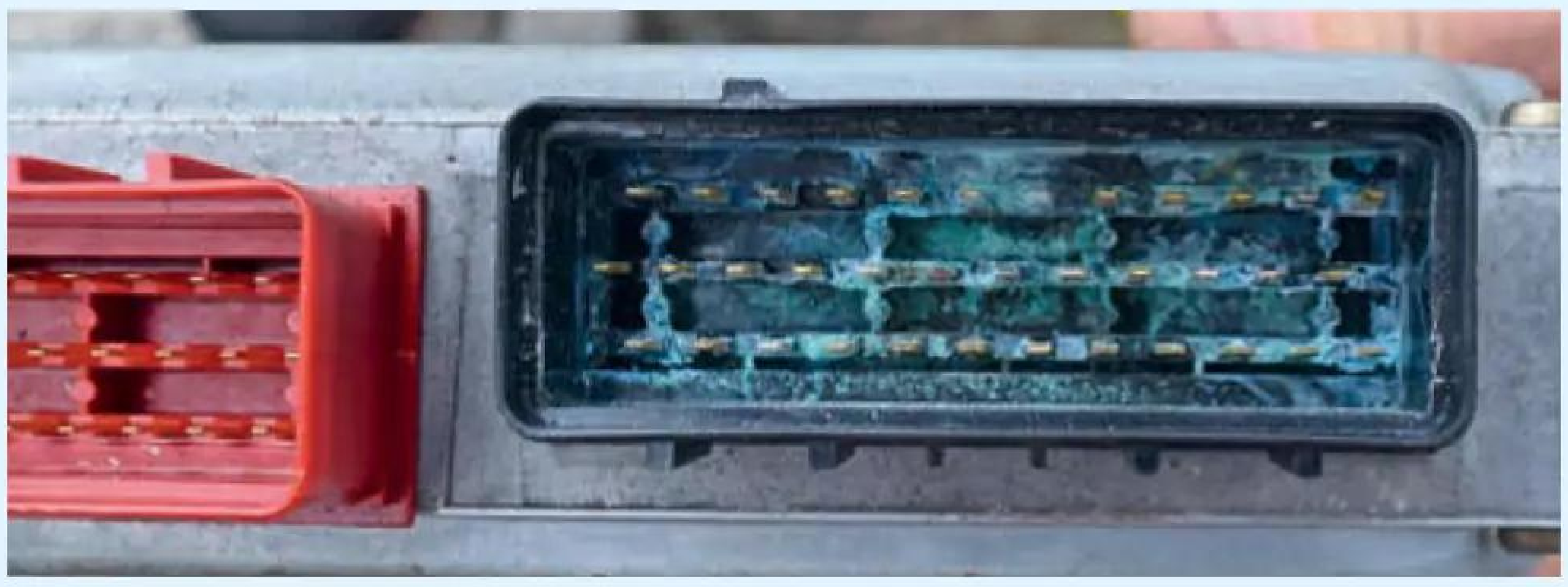
3 A useful test is to check for battery voltage in the main feed to the ECU. On this car we had 12.2 volts (as also measured at the battery itself). This figure is a little low, so the battery would need to be recharged.



4 Checking for voltage drop using a digital multimeter with long leads can be carried out in the feed and earth paths of the circuit and should reveal near zero loss. This will confirm a cable's internal integrity along the circuit to the component. High resistance impedes component operation and may result from corrosion or poor connections.



5 ◀ The ECU is located to the right of the right-hand footwell. Disconnect the vehicle's battery before attempting to release the ECU. To remove the ECU, carefully detach the twin connector blocks at the top of the unit and undo its securing bolts.



6 You may find serious corrosion within the ECU connector plug pins – in ours, one pin had dissolved due to long-term exposure to moisture. This is a common cause of no cranking (see *Fault 1*), but other electrical problems may be present.

which is packed with useful information, as are Jaguar's X300 handbooks.

For this feature we are investigating a 1994 X300 3.2 Sport, not supercharged. Our guide to the diagnostic aspects of this engine and its Sagem-Lucas GEMS 6 management system is Edward Haggar.

Preparation

Routine maintenance is not difficult as there's reasonable working room around the bay, with the ignition coils and spark plugs accessible at the top of the engine. The oil filter and drain plug are also easy to reach, as are many of the engine-mounted sensors.

The straight-six motors are renowned for being bulletproof and, given regular oil and filter changes, are capable of clocking up 250,000 miles or more. The automatic transmissions and final drive units are similarly strong and long-lasting, provided attention is paid to lubrication, in particular ensuring that the transmission fluid and final drive oil are clean and of the correct specification.

If the vehicle is new to you, check its service history. If in doubt, carry out a full service including all filters and engine oil. Always check the ignition coils, removing and inspecting them for signs of blisters/electrical tracking.

A basic method of checking for coil operation is to remove each spark plug in turn, reattaching its coil/high-tension connector and cranking the engine to check for a spark at the electrodes. Take care, though, to not touch the plug, coil

⇨

ENGINE MANAGEMENT

The Sagem-Lucas GEMS 6 management system used on this X300 incorporates these primary components:

- Sagem-Lucas GEMS 6 ECU with twin connector plug assemblies.
- 6 x pencil-type ignition coils.
- 6 x solenoid-type fuel injectors.
- Coolant temperature sensor.
- Crankshaft position sensor.
- Camshaft position sensor.
- Mass air flow (MAF) sensor.
- Throttle position sensor (potentiometer).
- Air temperature sensor.
- Electric fuel pump, fuse and relay.
- Body control module within fascia assembly.
- Rear electrical centre in boot.
- Multiple fuseboxes around the vehicle.
- Multiple electrical junction boxes/plug and socket assemblies.

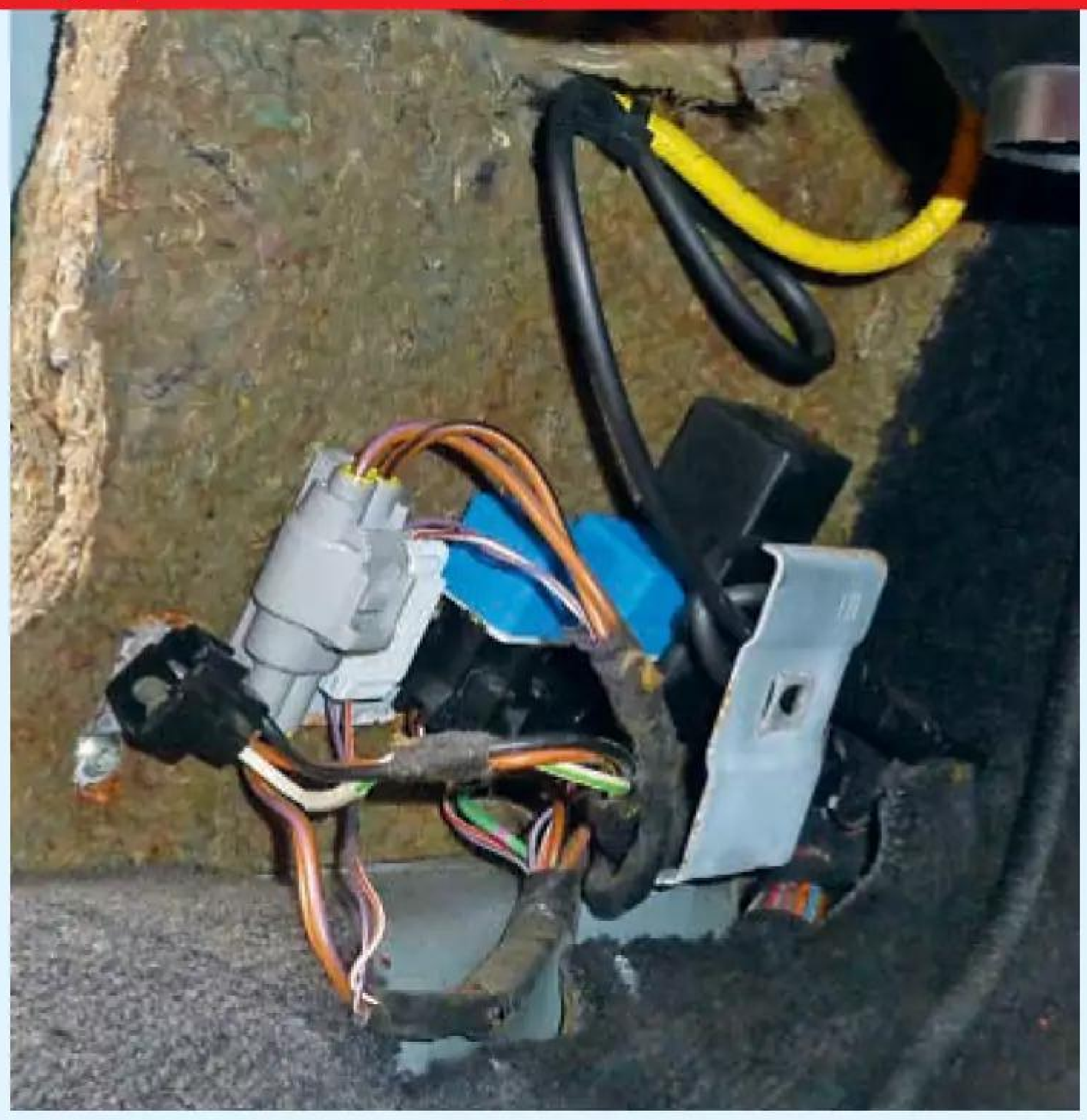
or leads while doing this, at the risk of electric shock.

As these cars age, problems can occur with the multitude of electrical connections, in particular the ECU and its plug/socket assemblies. Moisture entering these assemblies can result in running difficulties, including a very high or fluctuating idle speed. Eventually this will lead to an engine that won't crank (see *Fault 1*). The reason for the fault may not be immediately obvious. Indeed, many X300s have been scrapped due to being unable to identify the cause.

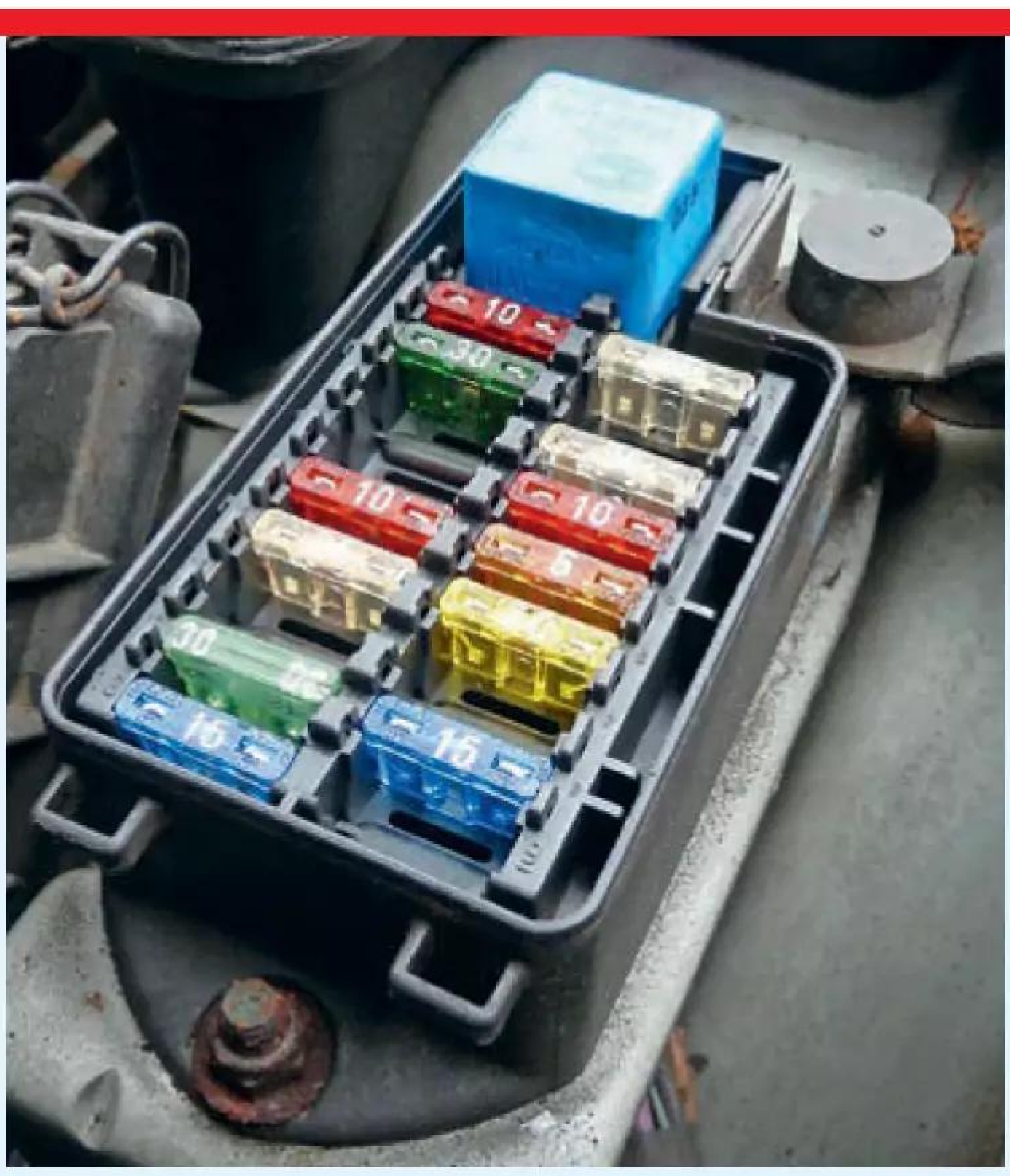
Other electrical ailments create havoc, too, so we advise carrying out a visual inspection of all electrical wiring, connectors, fuses and relay boxes around the vehicle. It is worth noting that specific information on fusebox location, fuse numbers, rating in amps and circuits protected, is given within the Roadside Emergency Service section of the Jaguar Vehicle Service Manual.

Not shown here is the crankshaft sensor, mounted at the front of the engine. This can fail completely and the engine won't run, but when it starts to break down, it can behave erratically, giving inconsistent running and a reluctance for the engine to rev freely. An initial check is to observe the tachometer needle as the engine is cranked on the starter motor, which should move to 200rpm if the crankshaft sensor is operating (although

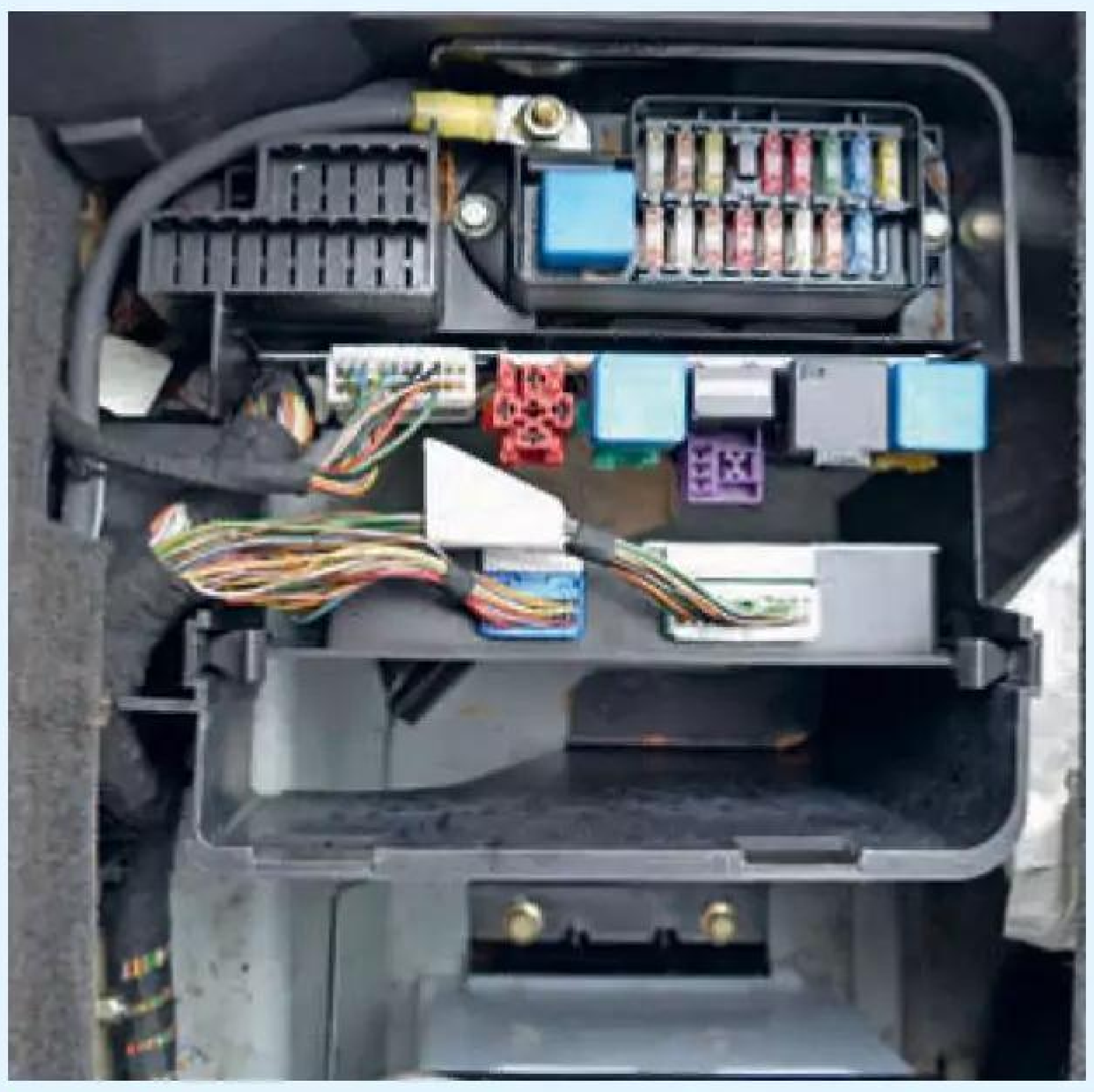
Typical Jaguar X300 components



7 ◀ **On the left-hand side of the car, normally hidden by a plastic cover to the left of the footwell, are a number of cables/connections. Remove the cover to check for moisture ingress in this area. Check all electrical components for condition and security.**

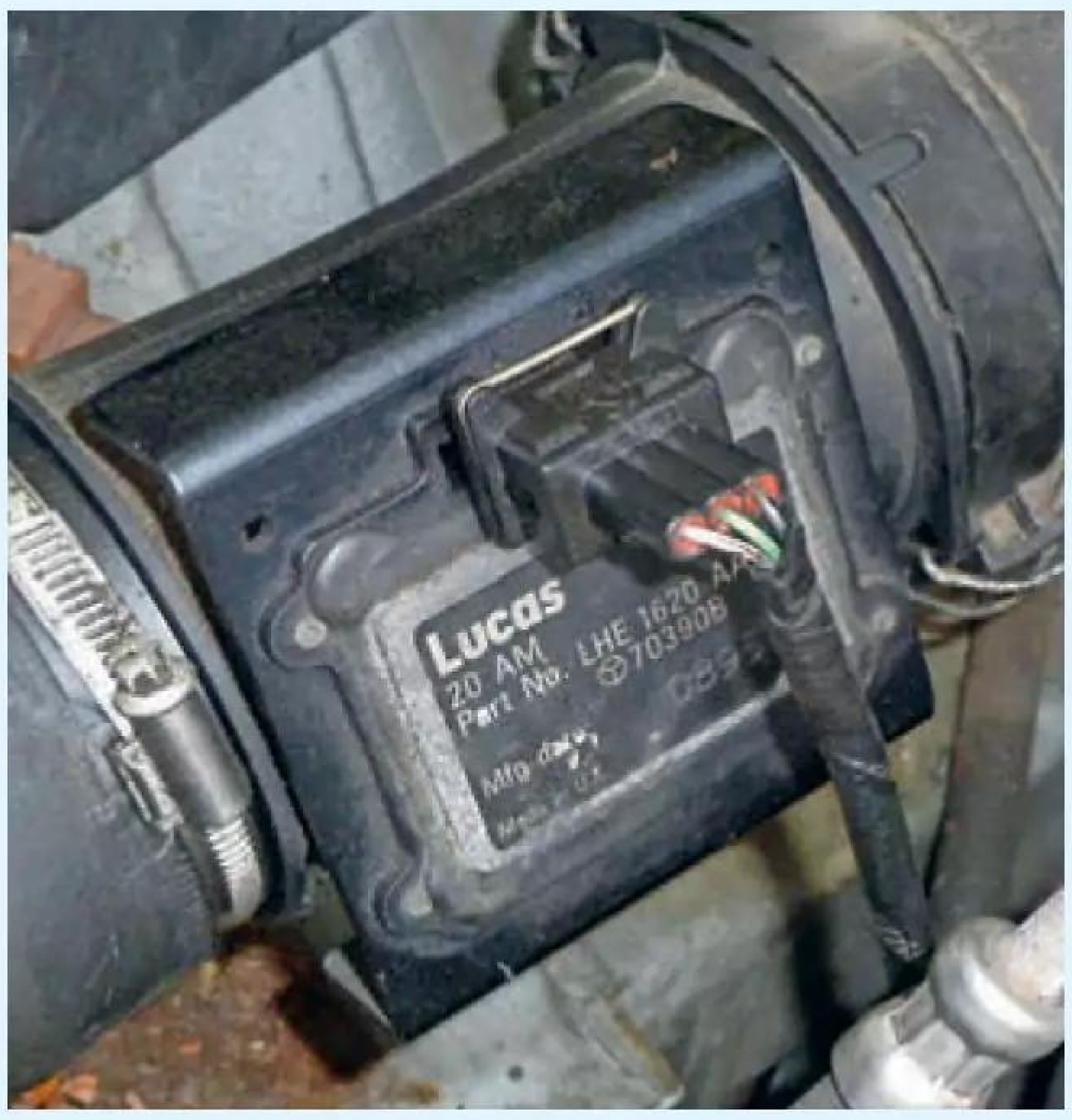


8 ▶ **There is a fuse/relay box on each side within the engine bay, just behind the headlamps, plus another in the boot, close to the battery, and one on each side beneath the rear seat (in the vertical panel towards the front edge of the seat base).**



9 **This electrical centre is located towards the rear of the battery compartment in the boot and is normally concealed beneath a false floor panel. On this car, all cables and connections were in excellent condition, but always check for moisture ingress.**

10 **Within the automatic transmission's selector assembly there's a built-in inhibitor switch set-up to prevent the car from starting if the selector is not in 'Park'. With the ignition on, you should hear clicking from the solenoid as the lever is moved in and out of 'Park'.**



11 **Located within the intake trunking is the mass air flow (MAF) sensor assembly, which monitors the rate of air flowing through the system, enabling the ECU to calculate appropriate fuelling levels.**

Tool of choice

▶ Short of dealer-level diagnostic equipment, the **Snap-on SOLUS** tool is helpful for some aspects of diagnostic interrogation. However, a quality digital multimeter with long leads will help with much of the circuit testing required, provided that you have access to wiring diagrams. These can be difficult to find, but technical information is available from Jaguar specialists.

We have not attempted to include a wiring diagram for the X300 in this feature, since this would require literally dozens of pages. The Jaguar Vehicle Service Manual contains diagrams covering each individual circuit in turn, as well as schematics showing how the circuits interrelate.

this test is not 100% foolproof). A simple resistance check on the sensor will reveal a failing within the windings.

Closer to the top of the engine is the camshaft position sensor (also not shown here). If this sensor is failing then the engine may suffer from extended cranking before it starts and runs normally. Check that the sensor is correctly positioned and that the electrical connection is good. Fitting a new sensor is not difficult, but it needs to be correctly set up. Note that, on the X300, some relays are switched via the earth side of the circuit.

During your diagnostic work it may be necessary to dismantle individual relays to test them. In each case, check all relay connections for signs of corrosion.

Technical Specs

Actual values

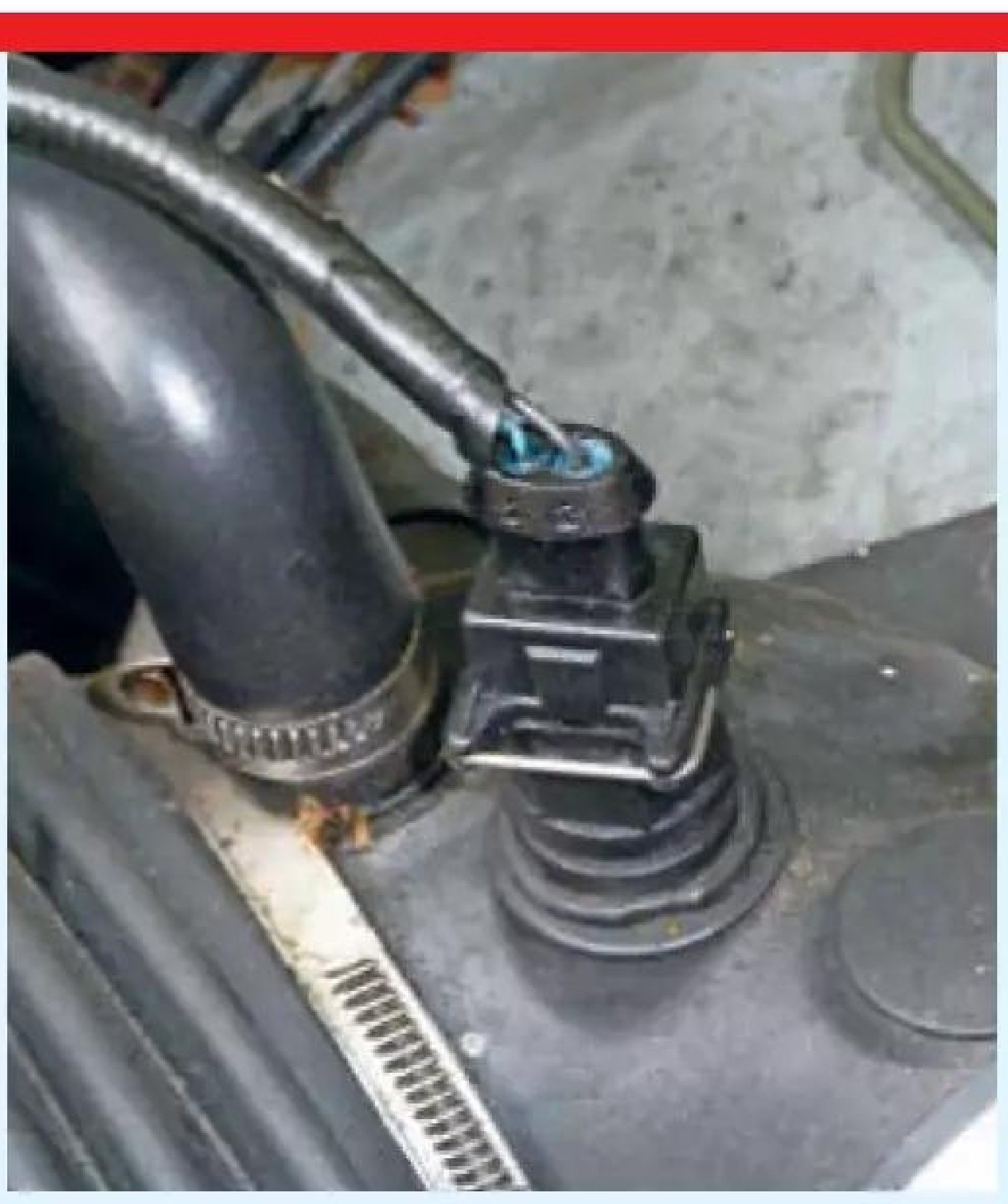
Component	Value
Engine coolant temperature 80°C	300 ohms
Injector resistance	15.5 to 16.2 ohms
Crankshaft sensor	1200 ohms

Throttle position sensor resistance check (sensor removed):

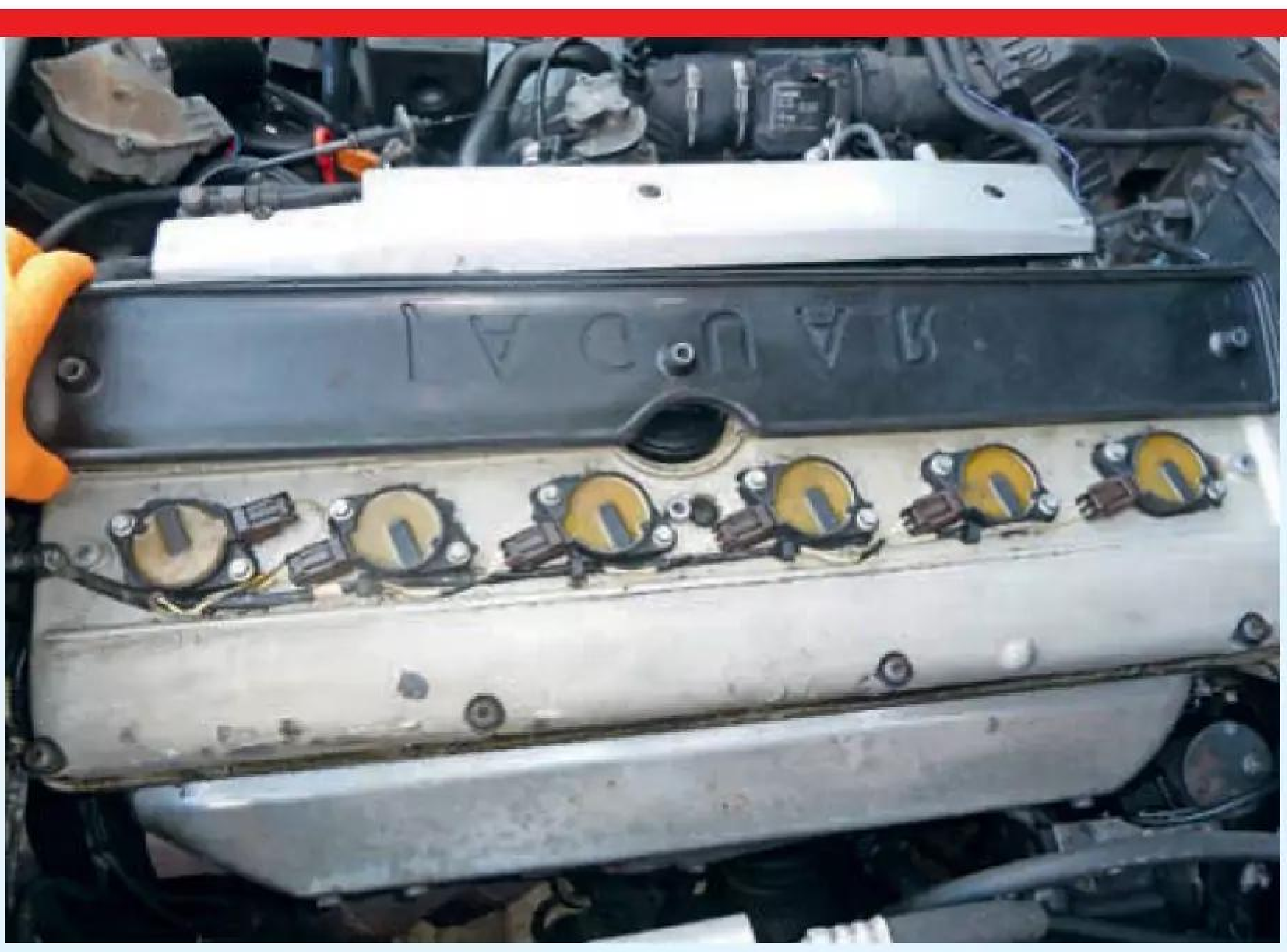
Blue/Black, 3390 ohms

Black/Green, 495-3450 ohms (moving smoothly as the throttle is rotated)

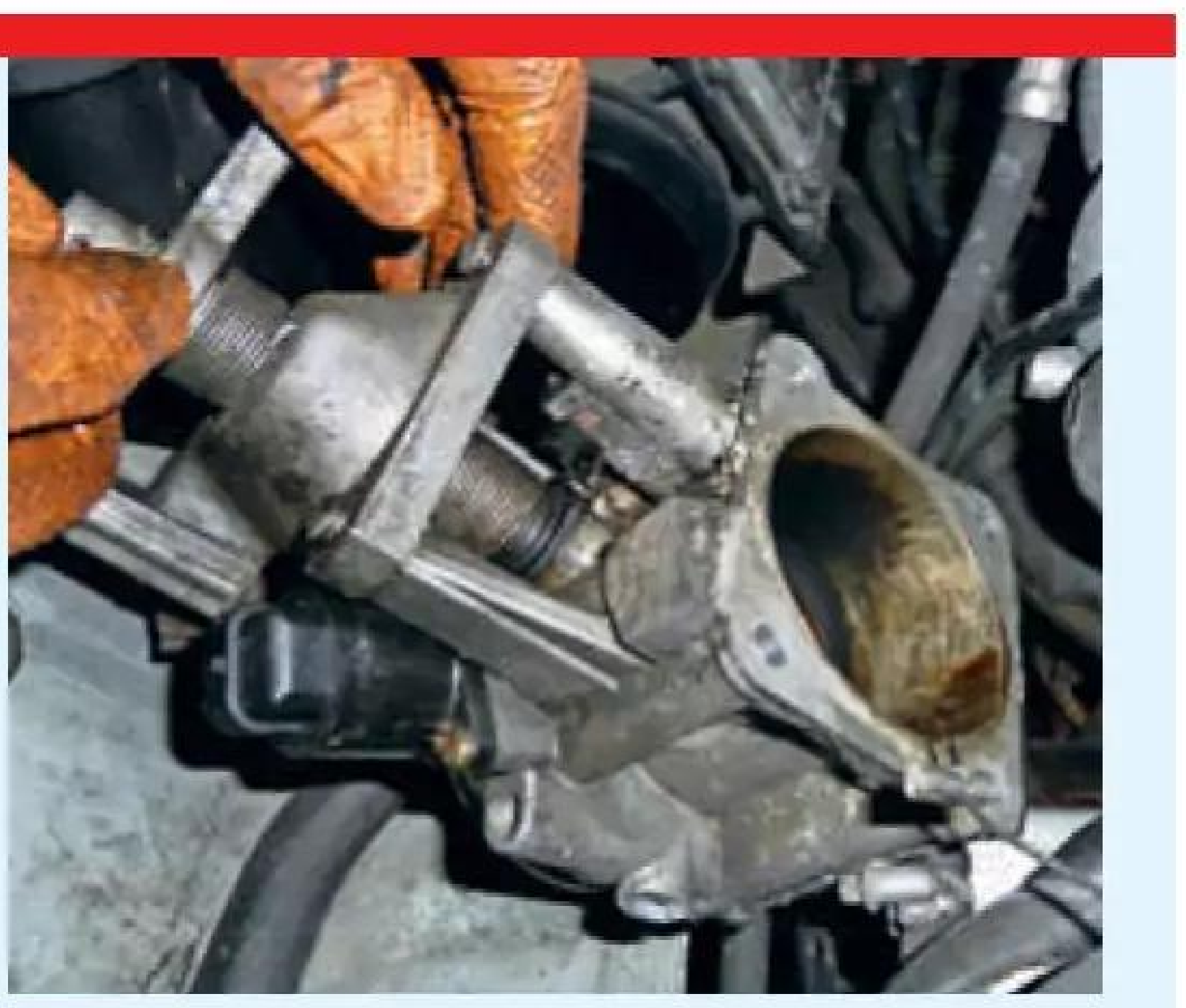
Blue/Green, 67-3050 ohms (moving smoothly as the throttle is rotated)



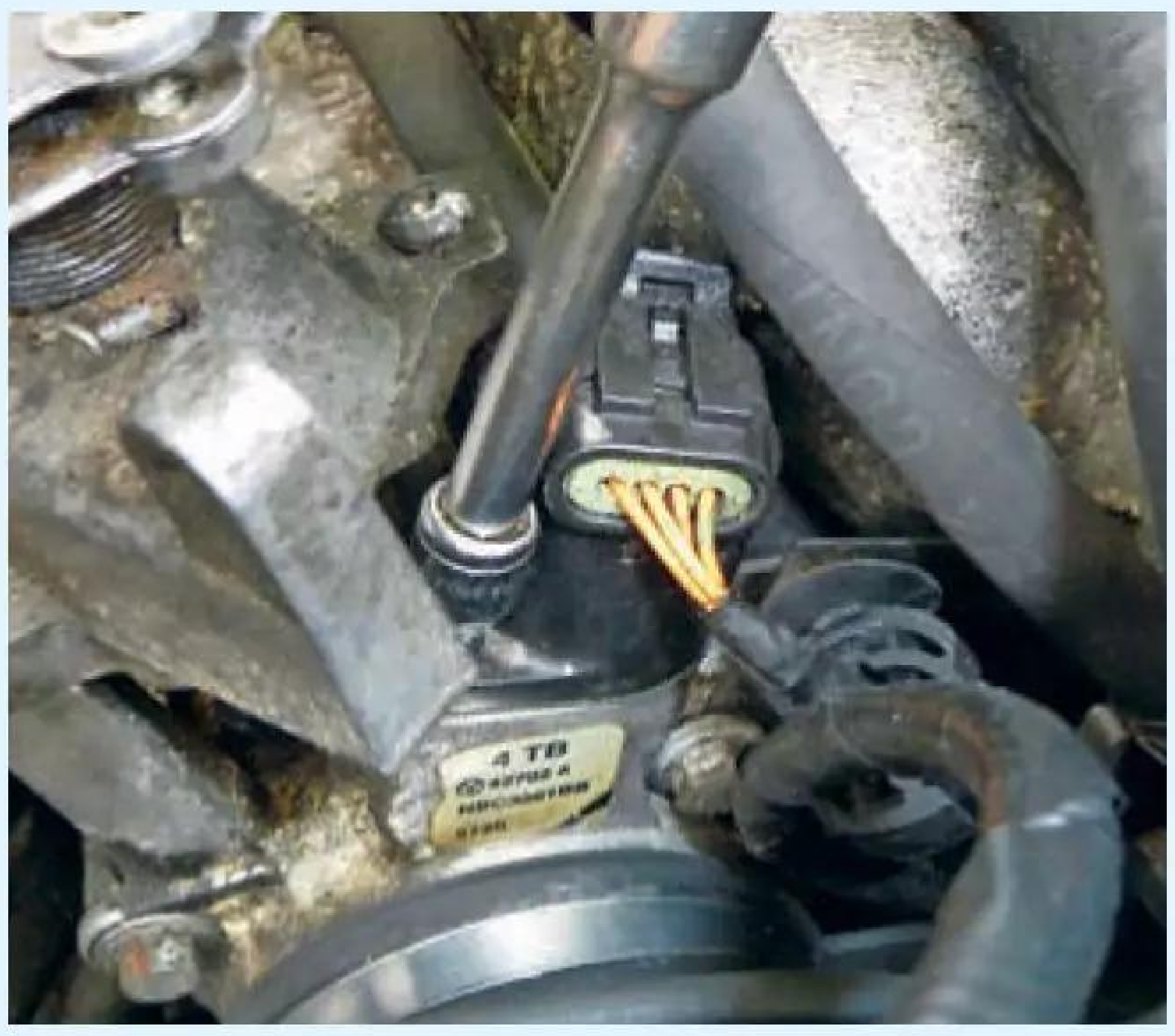
12 **Not far away from the MAF sensor and fitted within the right-angled section of intake trunking is an air temperature sensor. Its signals are also taken into account by the ECU in determining correct fuelling.**



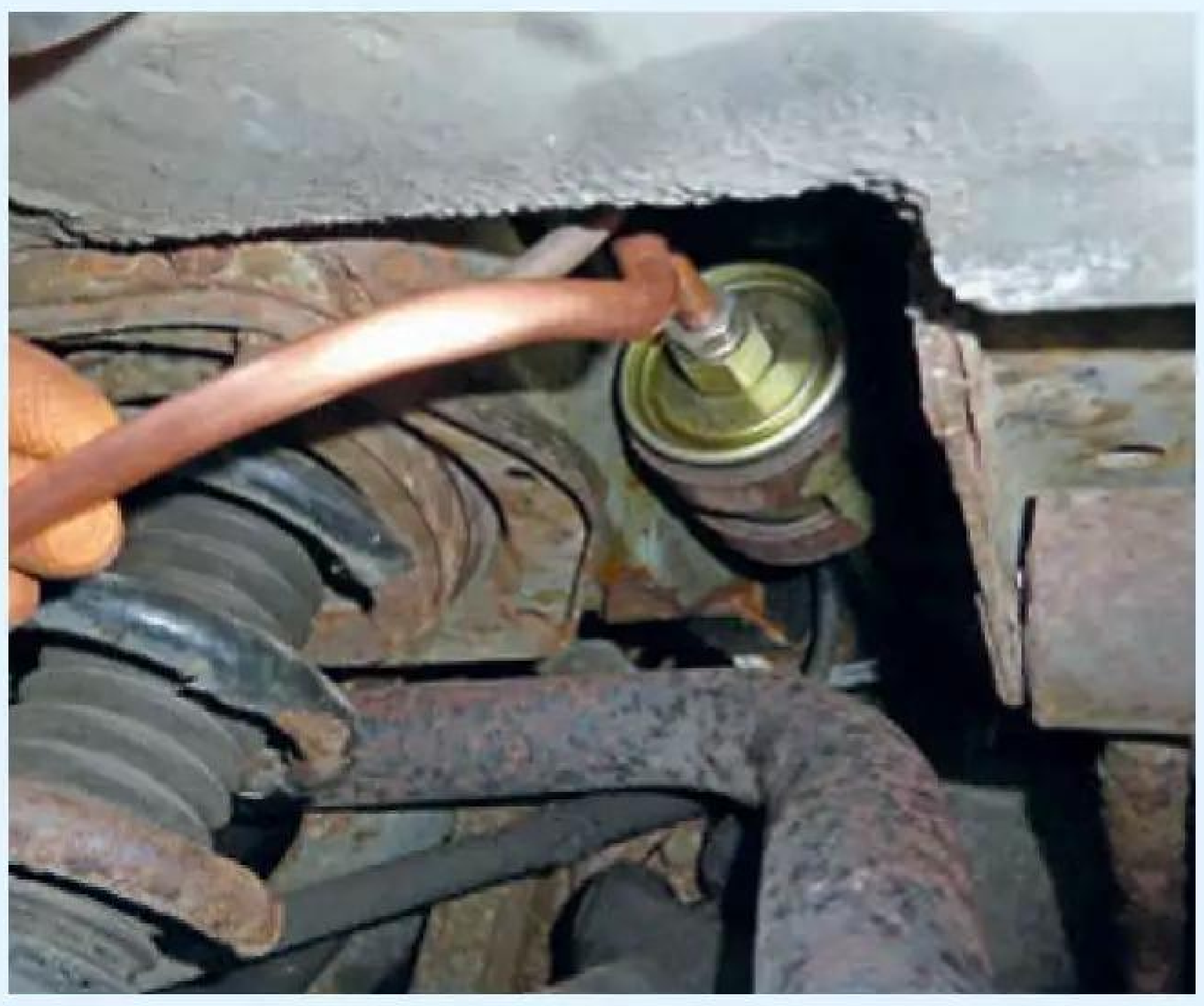
13 **To gain access to the six ignition coils, remove the cover panel (secured by three Torx T30 screws). Check that the coils and wiring are clean and secure, with no signs of burning (see *Preparation*). Renewal of the coils is straightforward: each one is secured by two bolts (8mm spanner).**



14 **The throttle body assembly must be clean so that the throttle flap moves easily. If it sticks, the idle speed may be too high (see *Fault 2*). Unbolt and remove the assembly, carefully clean the flap and its surroundings with purpose-designed cleaning fluid. Inspect the seal between the throttle body and airbox housing and renew it if it's damaged.**



15 **The idle speed control valve is positioned on the throttle body assembly. If the idle speed is still too high after cleaning the throttle flap, and after checking the inlet pipework for air leaks, the control valve may be ailing. Unbolting and cleaning it carefully may cure the trouble, or else a new valve may be needed.**



16 **Routinely renewing the fuel filter is important to avoid petrol starvation and ensure a supply of clean fuel to the injectors. The filter is located beneath the rear of the car, so is often ignored (see *Fault 3*). The original steel fuel pipes are rust-prone and may break when the filter is removed. On this car, longer-lasting copper pipes with brass unions were fitted.**

17 **If there is only one key-fob assembly available, it's wise to acquire a second one and programme it. If renewing the batteries (two x CR2016), the job must be done within two minutes to avoid losing the transmitter code. Use a screwdriver through the key-fob slot to carefully release the retaining clip and open the cover to renew the batteries.**

USEFUL DATA

Below are shown the official change intervals for the various components. However, we recommend that these are at least halved.

Engine oil Every 10,000 miles or 12 months, whichever comes first.

Oil type SAE 10W-40 semi-synthetic. **Capacity** (service fill) 8 litres.

Air filter Every 20,000 miles or three years.

Spark plugs Every 20,000 miles. Use Champion RC9YCC or NGK BCPR6E-VG (or equivalent), gapped to 0.9mm.

Firing order 1-5-3-6-2-4. **Fuel filter** Every 60,000 miles.

Idle speed 800rpm ± 50rpm. **Brake fluid** Every two years.

Fault 1

MOISTURE INGRESS IN THE ECU

As X300s have aged, this fault has become more prevalent, manifesting itself with the engine refusing to crank. Before you waste time testing the battery and searching for a break in the circuitry between the battery and the starter motor, take a close look at the ECU and its connections.

The ECU is located within a small cavity to the right of the right-hand front footwell, and is normally hidden behind a cover panel. Rainwater can enter from above as a result of a leaking windscreen seal or sunroof. As the ECU's electrical connections are on its top, the water can soak through into the ECU itself.

Before disconnecting anything, check what happens when the ignition key is turned. If the 12V battery is fully charged, all the dash warning lamps should light up when the ignition is turned on, then extinguish within a few seconds. After this, the 'Engine Check' light in the lower left-hand corner of the instrument panel should re-illuminate to confirm that the ECU is OK. If this lamp doesn't light, there's a problem with the ECU.

To gain access, disconnect the battery and then carefully release the cover panel and detach its rear vertical edge from the door aperture seal. Once you have access to the ECU, detach the twin connector socket assemblies from the top of the ECU, then unbolt the ECU from the car. Note: A vital earth cable is attached to one of the securing bolts; remember to reattach this on reassembly.

With the ECU out of the vehicle, examine the connector pins – they should be dry and with no evidence of corrosion. Also inspect the socket assemblies that connect to the ECU, which should also be sound, dry and clean. Electrical contact cleaner spray can be used to deal with minor dirt and corrosion on the connector pins/sockets. However, in severe cases, one or more of the pins may have completely dissolved.

If things are really bad, water may also have run down into the ECU. The ECU's cover can be unscrewed to check the internal components. If you find corrosion or moisture within, or if one or more of the connector pins has been damaged, replace or refurbish the ECU.

It is essential to fit a compatible ECU, ideally from a vehicle very close in age to yours and with the same part number. Fitting an earlier or later unit may allow the vehicle to start and run, but could result in running difficulties, such as a markedly high idle speed or a fluctuating idle. The number '211' after the '/' in the part number indicates that the unit is for a car with automatic transmission, whereas '212' denotes a manual gearbox.

Before installing a new ECU, cure the moisture ingress problem, either clearing any blocked drainage channels or replacing the windscreen's rubber seal. If the seal is still sound, drying and cleaning the groove in the seal and applying a butyl rubber/mastic type of sealant can do the trick. When replacing the ECU, the generous application of petroleum jelly or water-resistent silicone grease around the connector block assemblies at the top of the ECU provides a line of defence for the future.

Fault 2

STICKING THROTTLE BODY FLAP

With this problem the car won't idle at the recommended 800rpm, but instead rises to 1500-2000rpm with no throttle applied. This is potentially dangerous, especially on automatics, because the brakes need constant application to keep the car in check in slow-moving traffic. It also means the vehicle would fail an MOT or roadside emissions test.

Try cleaning the throttle body flap and adjacent areas in the throttle body assembly. If the idle speed is still too high, clean the idle speed control valve attached to the throttle body. If cleaning doesn't effect a cure, it may be necessary to renew the idle speed control valve.

Another possible culprit is the throttle position sensor. You can test this using a digital multimeter set to 'DC volts' on the signal wire, looking for a gradual increase in the voltage as the throttle moves. If the voltage reading sticks, this is a sign that the internal track is worn; an oscilloscope will show the fault more clearly. If your car's sensor is worn, you will need a new one or a complete secondhand unit in good condition.

It may also be found that moisture in the connector block assemblies serving the ECU are causing the problem (see also *Fault 1*). Restoring the management system to factory settings using a suitable diagnostic tool may temporarily reset the idle speed to the correct levels, but the trouble will reoccur as more moisture takes its toll.

Note that corrosion anywhere in the electrical circuitry can cause havoc as the resulting high resistances can affect the signals being relayed to the ECU.

Fault 3

CHOKED FUEL FILTER

Neglected X300s can suffer a multitude of running problems due to lack of maintenance. These include a reluctance of the engine to start, inconsistent firing/hesitation and a feeling that the engine is holding back and not delivering full power. Rough or inconsistent running can result from worn out or incorrect specification spark plugs and/or a choked fuel filter. The engine is sensitive to spark plug resistance and if the coils are having to work harder due to worn plugs extra strain is placed on them. Worn-out spark plugs may manifest themselves in the form of a mild misfire, eventually building to bigger problems.

The fuel filter is often ignored for long periods due to its inaccessible location beneath the rear of the vehicle. Because the original mild steel fuel pipes in the vicinity are prone to damage as the old filter is removed, you should work with care and ideally renew the fuel pipework in this area with longer-lasting copper pipework and brass unions.

Fault 4

BRAKE LAMP or SWITCH FAULTS

If brake lamps are non-operational, the X300 is designed so that the driver will not be able to engage 'Drive' or 'Reverse' due to the selector interlock mechanism preventing engagement as the brake pedal is pressed. Check the brake lamp bulbs and ensure that the brake lamp switch is operational.

Electronic Diagnostics

FORD KA II 1.2

Tracing and fixing faults in electronic engine management systems

Kim Henson and **Edward Haggar** take a close diagnostic look at a 1.2-litre Ford Ka with the Fiat-developed FIRE engine.

Ford's boldly-styled Ka three-door hatchback arrived in 1996 as the smallest car in the company's line-up. Second-generation models were introduced in 2008, with more a conventional appearance and produced in Poland by Fiat for Ford. For this feature, we are looking closely at a second-generation Ka, first registered in November 2012, fitted with Fiat's 1.2-litre FIRE engine, but with the power unit badged as a Ford Duratec.

FIRE stands for Fully Integrated Robotised Engine and Fiat developed it in the mid-1980s to provide a conventional, reliable and efficient overhead camshaft unit. Since then, they have been produced in a variety of capacities, with early uses including powering contemporary Uno and Panda models. They are reliable engines that have stood the test of time and are especially easy to maintain.

Our guide to the diagnostic aspects of our Ka and its Magneti Marelli IAW 5SF8 management system is Edward Haggar.

Preparation

These Fiat-powered Kas are a doddle to service, so there's no excuse for not frequently changing the various fluids and filters. Diligent attention in this regard will be repaid by longer engine life and increased reliability. Always use the engine oil type recommended by Ford, and use Original Equipment-quality components when servicing the car. Note that, on this engine, the valve clearances are not hydraulically-controlled but need to be checked and adjusted manually.

Even jobs that are often considered difficult are straightforward on this Ford, including clutch and cambelt changes.

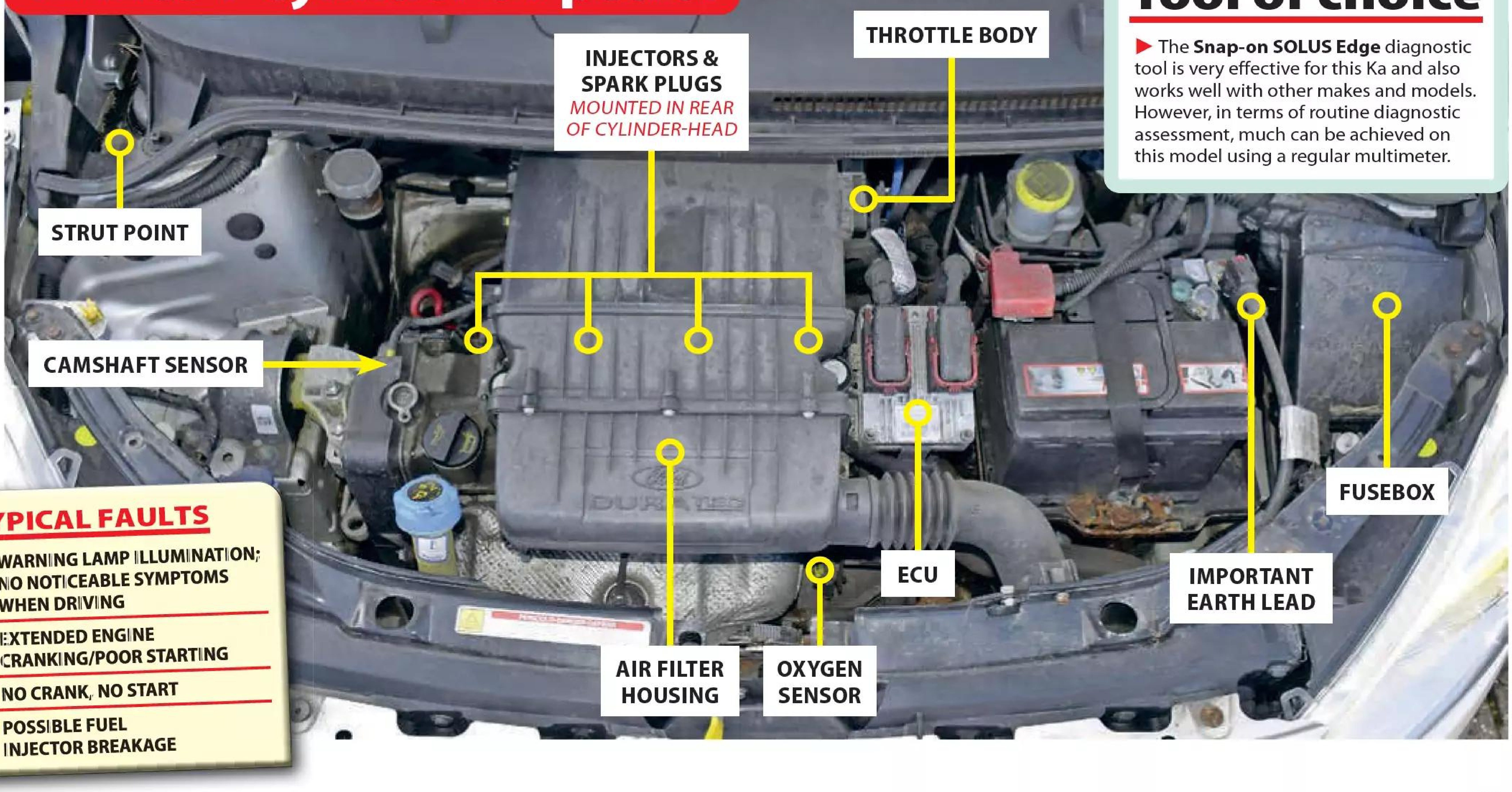
NOTES:
All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Fault 1

OXYGEN SENSOR HEATER CIRCUIT FAILURE

Our first fault presents itself with a vehicle that will run fine, but a warning light will be triggered. Carrying out a basic fault code check, even using a low-cost EOBD reader, will show the fault code 'P0030 heater oxygen sensor heater circuit bank 1 circuit malfunction'.

1242cc 4-cylinder 8v petrol



Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is very effective for this Ka and also works well with other makes and models. However, in terms of routine diagnostic assessment, much can be achieved on this model using a regular multimeter.

TYPICAL FAULTS

1. WARNING LAMP ILLUMINATION; NO NOTICEABLE SYMPTOMS WHEN DRIVING
2. EXTENDED ENGINE CRANKING/POOR STARTING
3. NO CRANK, NO START
4. POSSIBLE FUEL INJECTOR BREAKAGE

ENGINE MANAGEMENT

The Magneti Marelli IAW 5SF8 management system used on this Ford incorporates these primary components:

- Coolant temperature sensor.
- Mass absolute pressure (MAP) sensor.
- Digital cam sensor.
- Fly-by-wire throttle body.
- Underbonnet fusebox with relays.
- Inductive crank sensor (Note: On Stop-Start versions there is a digital sensor).
- Pre- and post-catalyst oxygen/O2/ Lambda sensors.
- Twin-plug ECU.
- Fuel pump mounted as part of sender in tank.
- Accelerator pedal with position sensor mounted on it.

Essentially the ECU is sensing a fault in the heater, which lies within the oxygen sensor heater circuit line.

The oxygen sensor is located directly in the exhaust manifold with a four-pin plug connector. Simply disconnect the connector and, with your multimeter set to 'ohms', connect against the two grey wires. You will likely see no reading, which indicates an internal open circuit within the sensor.

Replacement of the sensor requires either a special socket or spanner. It’s worth either running the engine for a while to warm things up or else applying a suitable penetrating fluid to aid removal. Sometimes the threads in the manifold will strip when removing the sensor. To overcome this problem you can try cleaning the threads with a suitable tap or employing a thread insert such as a Helicoil.

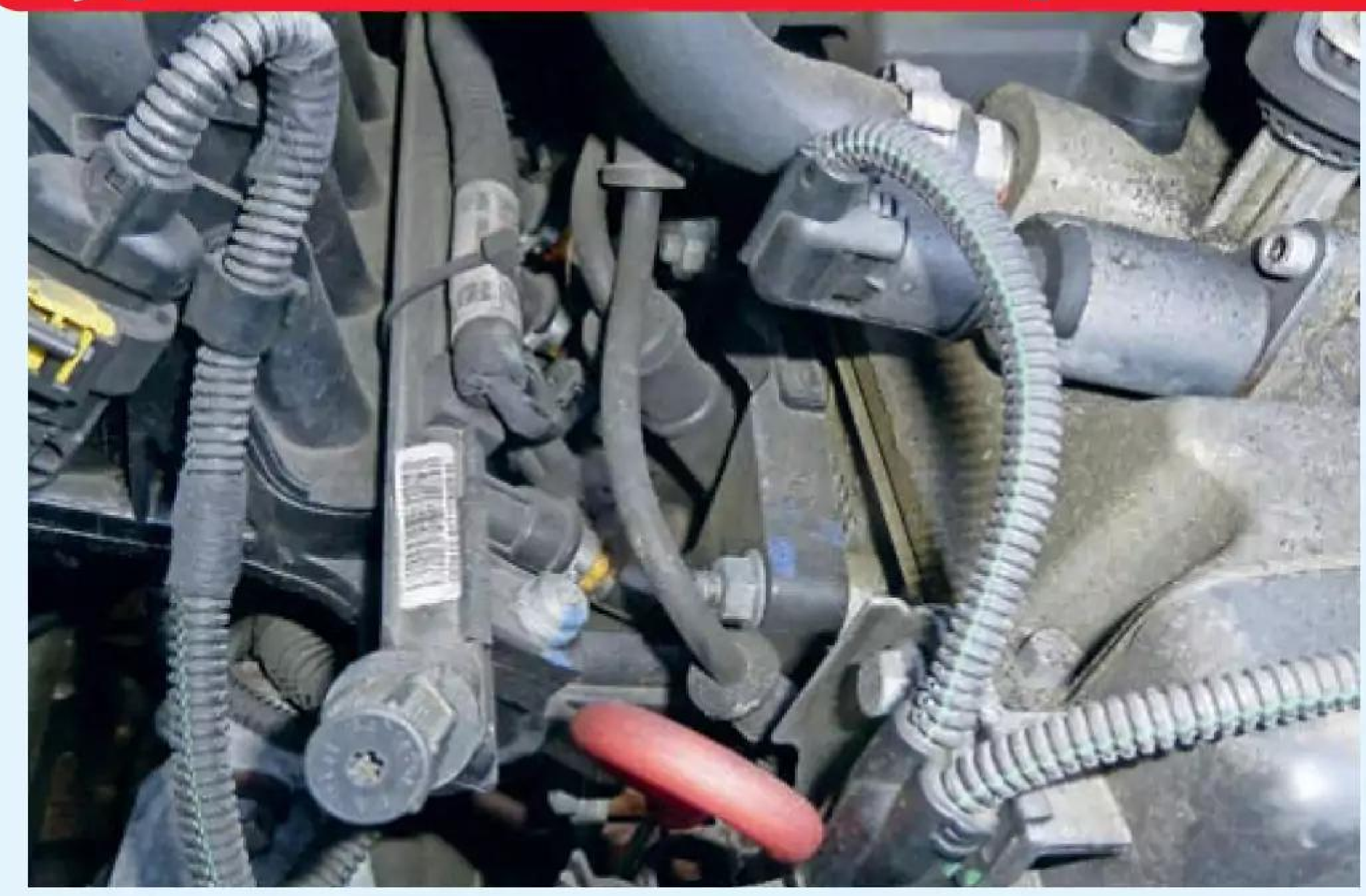
We recommend fitting good quality replacement sensors because cheaper items don’t last as long.

Fault 2

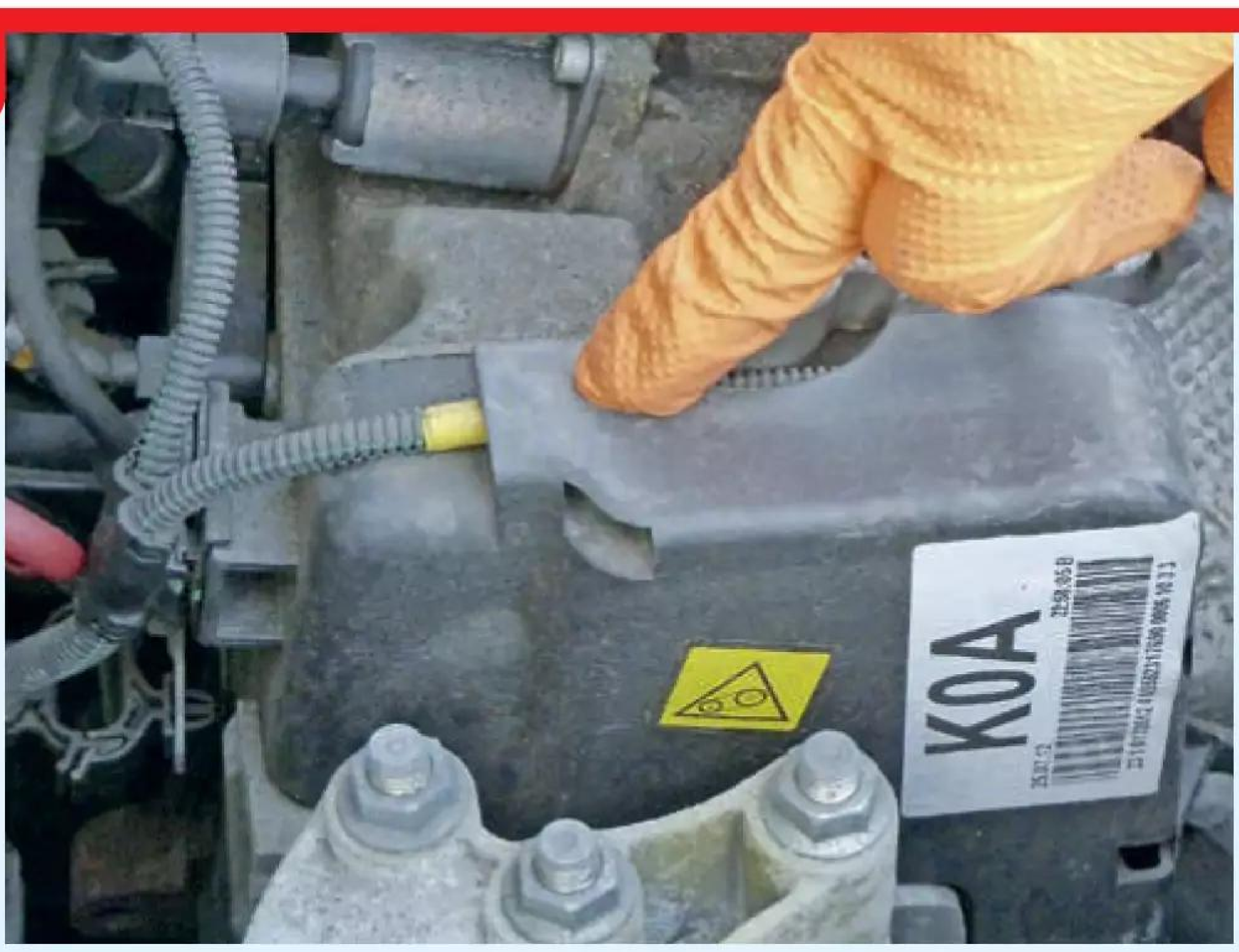
CAMSHAFT POSITION SENSOR FAILURE

With this problem, the vehicle may suffer from extended cranking and poor

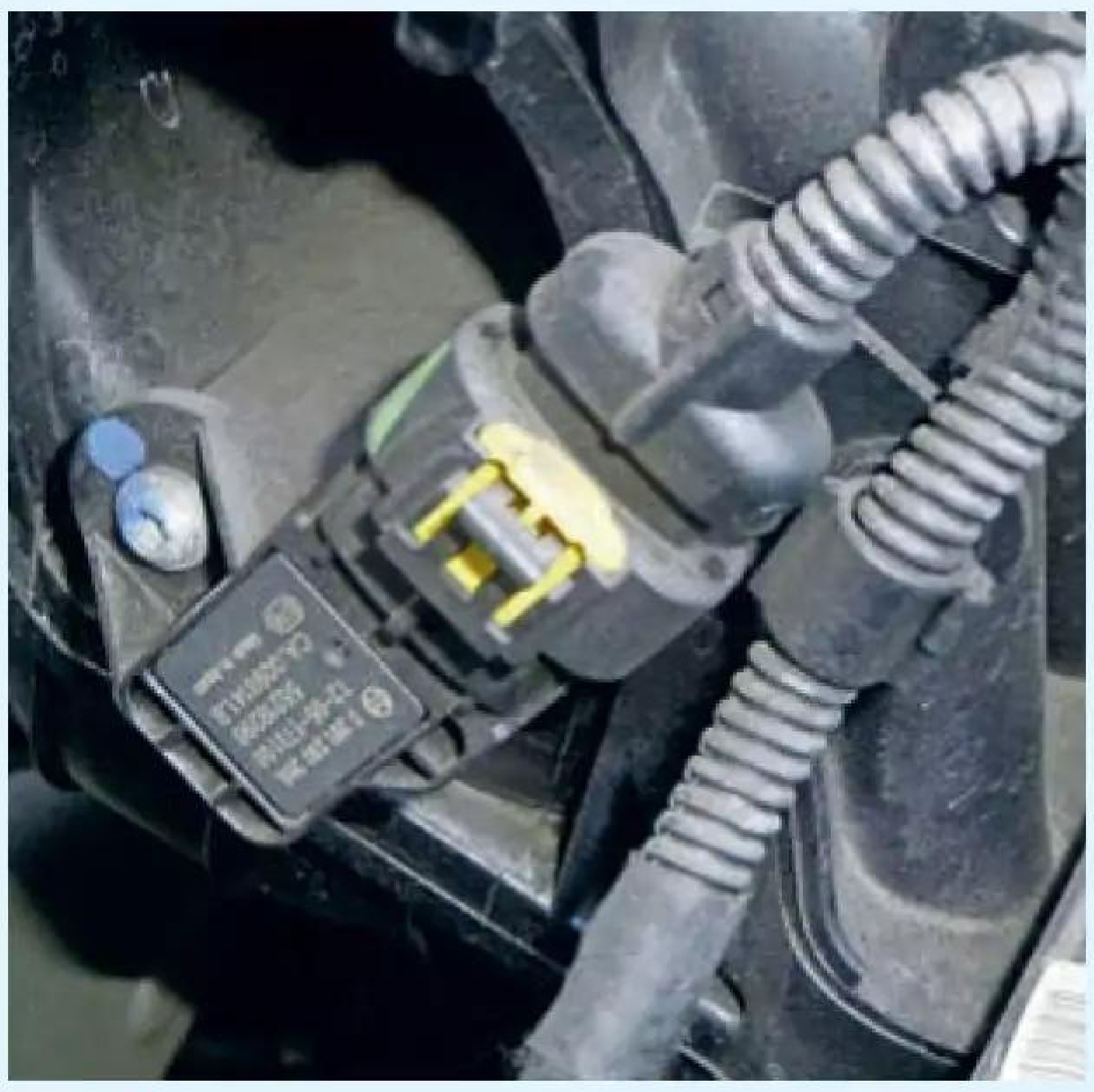
Typical Ford Ka II components



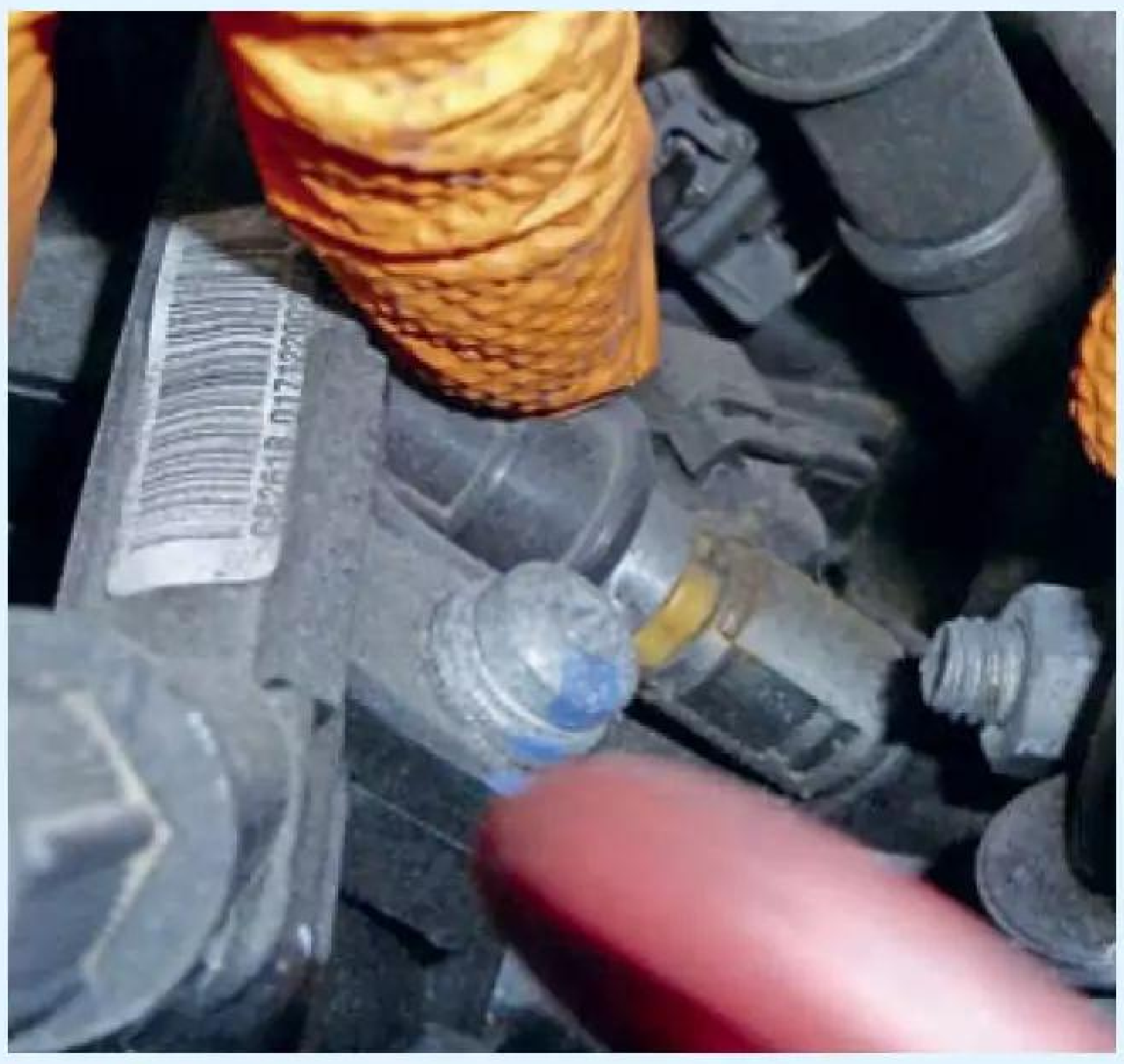
1 **The high-tension ignition leads (visible in the centre of this photograph) are prone to deterioration as they age, resulting in misfires. Closely inspect the leads and always treat them with care when handling to minimise the chance of damage.**



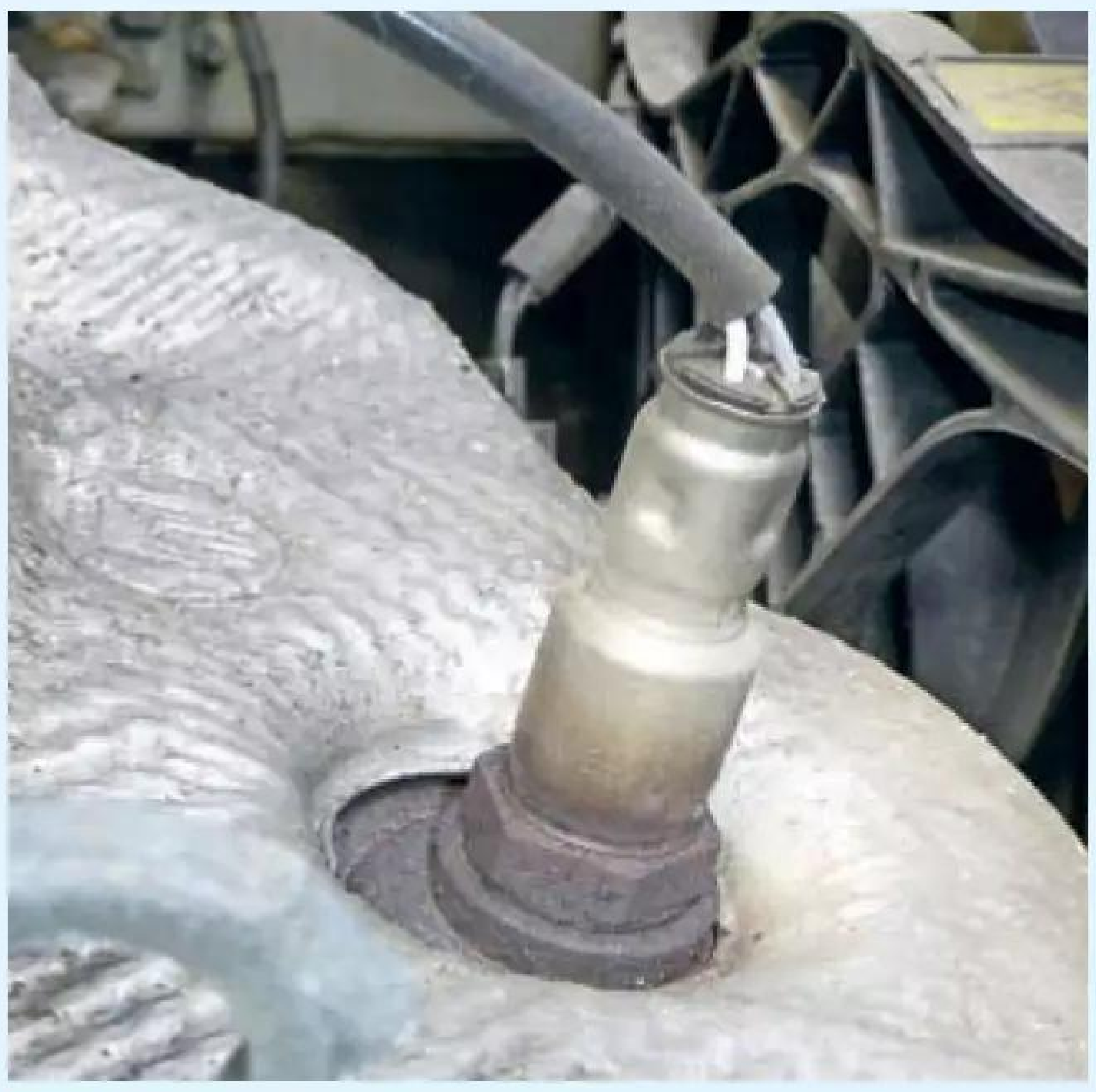
2 **Here’s the location of the camshaft sensor, hidden beneath the upper section of the cambelt cover. This sensor monitors the camshaft position and feeds the information to the ECU, which uses it to determine ignition and fuel injection timing.**



3 **The mass absolute pressure (MAP) sensor is found on the inlet manifold, at the rear of the engine. Its function is to send to the ECU information on the pressure within the inlet manifold, enabling the ECU to calculate and apply correct fuelling levels.**



4 **The fuel injectors are hidden away at the top rear of the engine. They are conventional solenoid types and renewal is straightforward. However, always renew the O-rings with the injectors, since even a small leak can cause issues. No coding is required when fitting new injectors.**



5 **This shot shows the pre-catalytic converter oxygen/O2/Lambda sensor, located near the top of the engine. Assess the physical state and security of the sensor, ensuring that the electrical cable and connections are sound and secure.**

starting, but when started the car will usually drive fine until stopped again. Carrying out a diagnostic check will show fault codes relating to camshaft position. In effect, the ECU isn't seeing a suitable signal, hence the extended cranking because the ECU is triggered via the crank position.

A first quick check, if available on your tester, is to look at the live data for crank/cam correlation. This compares the crank and cam timing to see if the timing has jumped – bear in mind that a loose cambelt could flag the same codes, although this happens only rarely.

An oscilloscope is the best tool for checking the Hall Effect-type sensor, incorporating a 5-volt supply, earth and signal. We have found that connecting a multimeter to the signal wire and cranking the engine will show no signal, but some less sophisticated meters might not pick this up properly.

The sensor is simply held in place via a single bolt (10mm spanner size).

Fault 3

POOR BATTERY EARTH CONNECTION

When this fault occurs the driver will experience non-starting. It is also possible that, when diagnostically assessing the car, there will be no connection with the ECU via a code reader. Some car owners will replace the battery and starter motor, only to find the fault remains.

A quick test here is to wiggle the earth wire. This usually brings the engine back to life, albeit only temporarily.

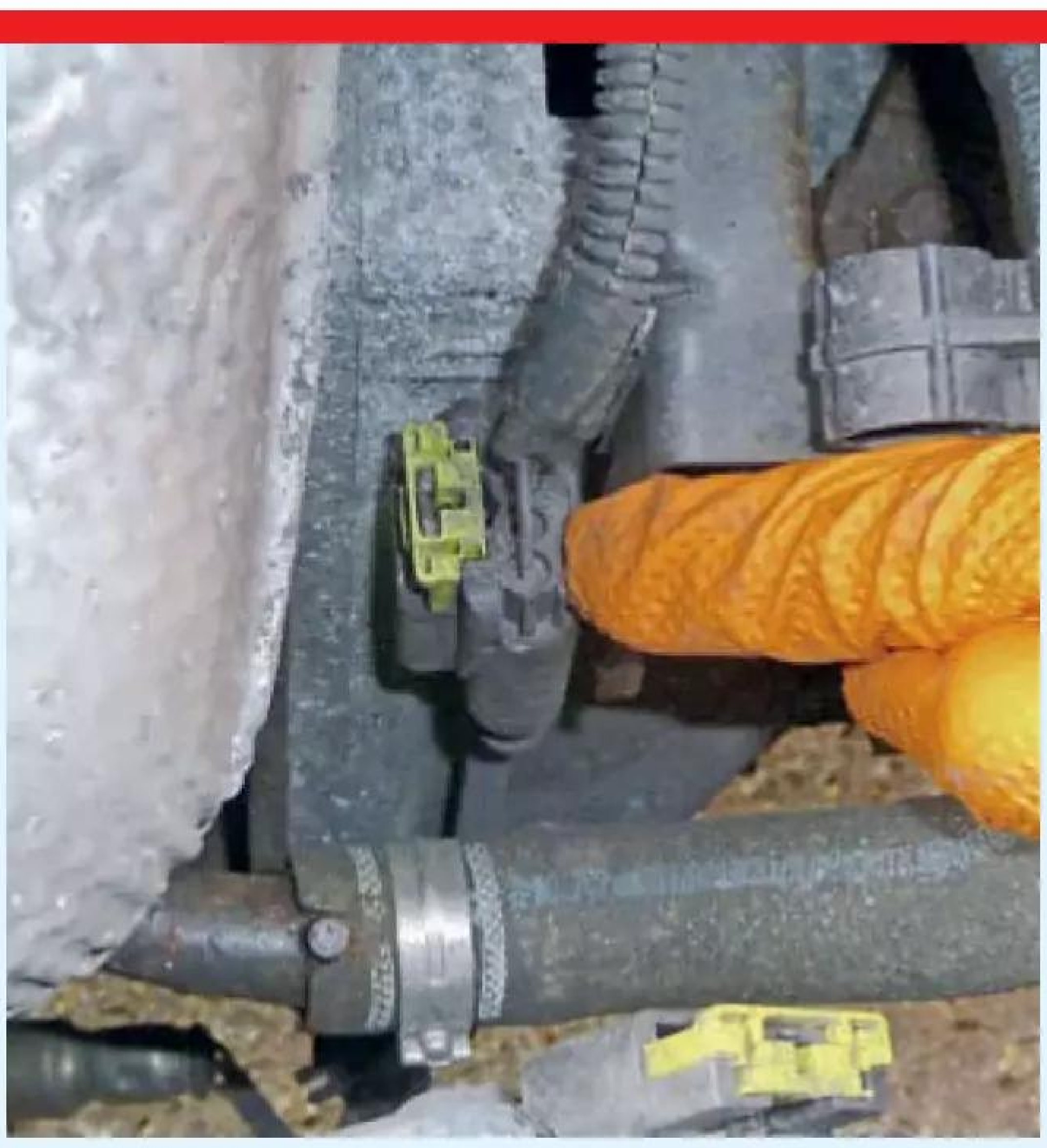
The fault lies with the earth lead from the battery, which can corrode internally. We had to deal with one example in which the cable looked perfectly fine from the outside but, when cut open, was badly covered in green corrosion.

When testing this, apply a simple volt drop check on the earth lead – ie, from the battery's negative terminal to the end of the lead's earth point. A reading of about 0.50 volts indicates the cable is OK. As a rule of thumb, the higher the voltage here, the higher the level of corrosion. Most motor factors can supply a new lead and it's worth coating it with grease to prevent the fault reoccurring.

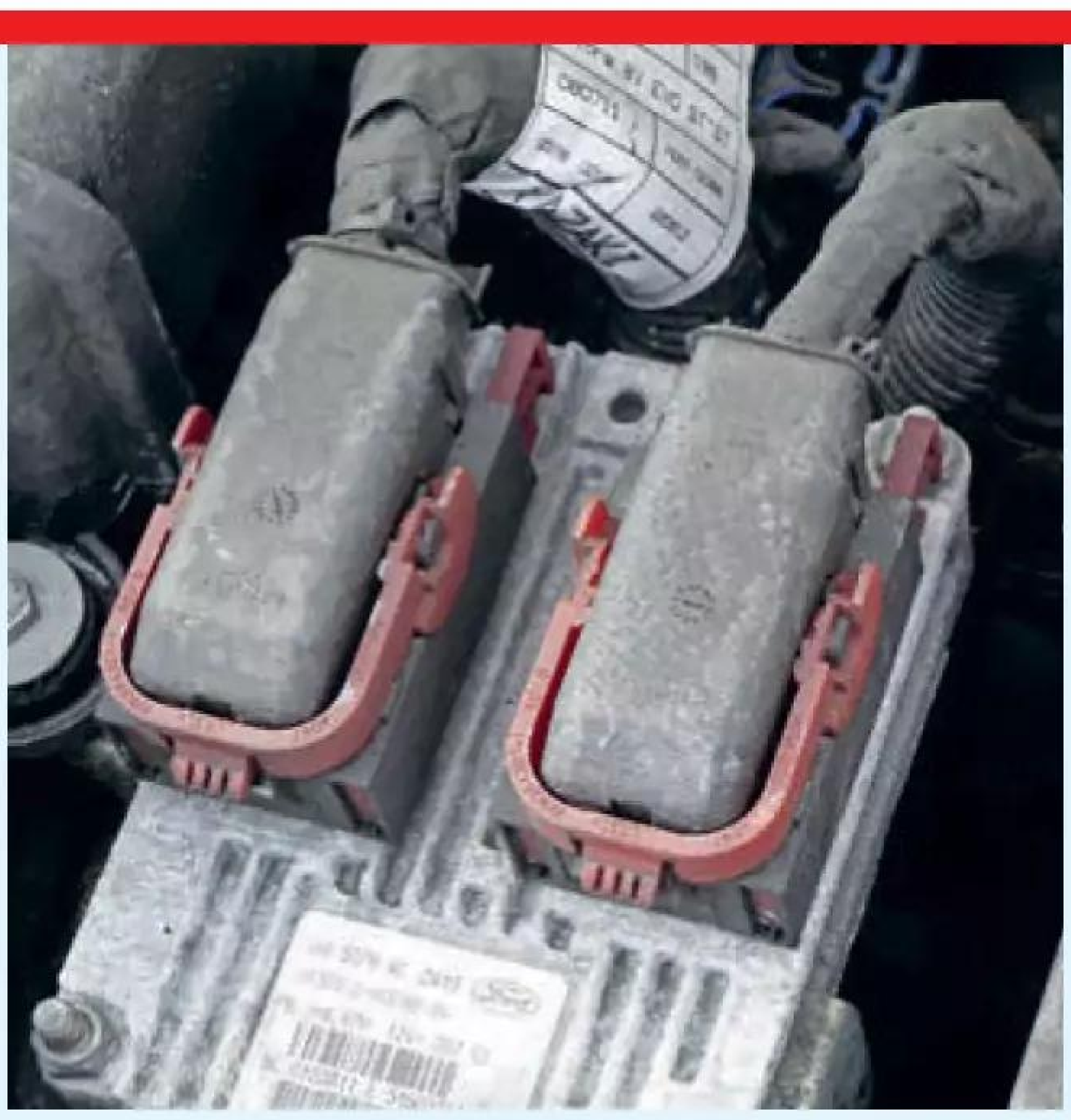
Fault 4

CARELESS SPARK PLUG REMOVAL

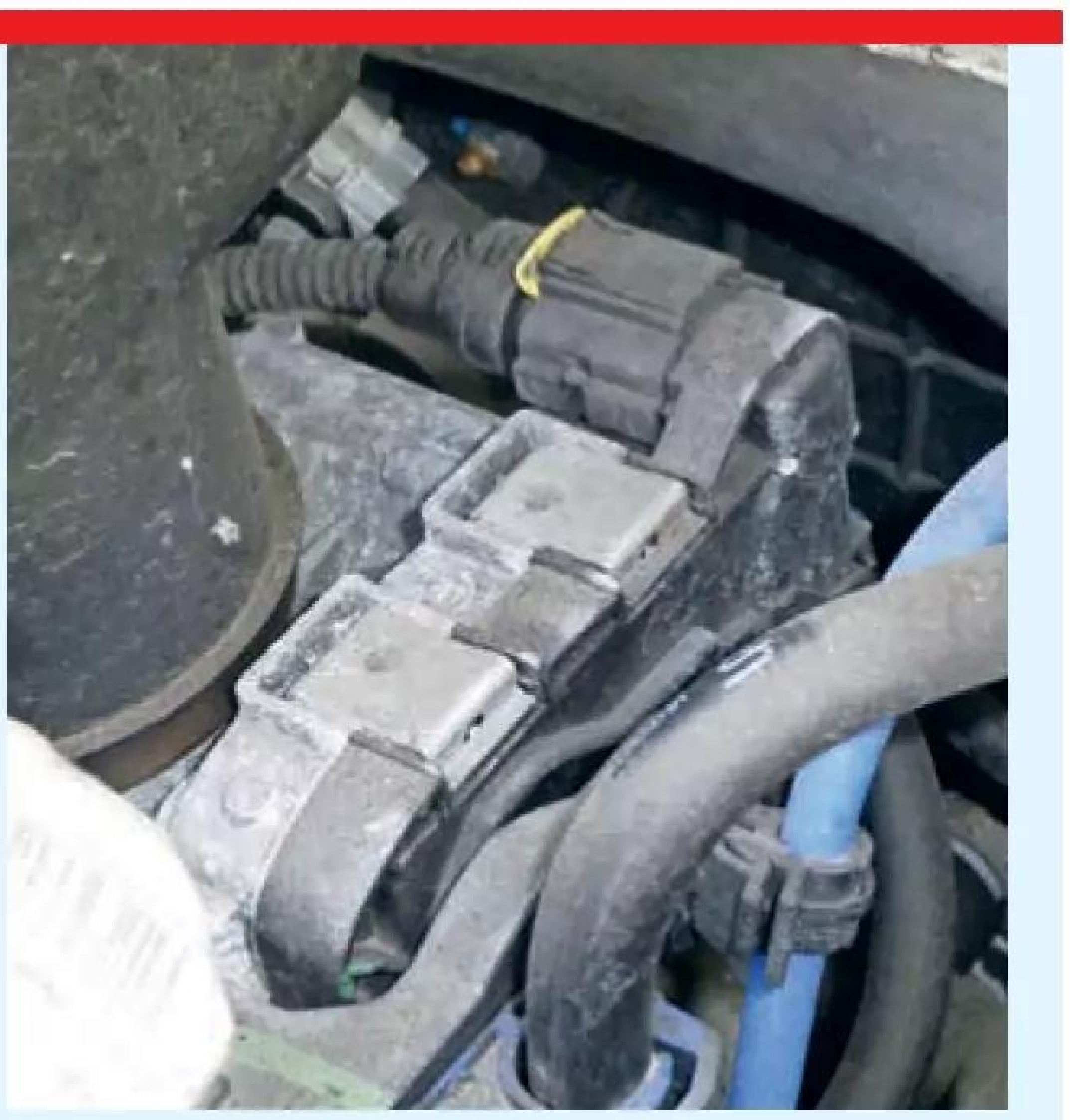
When replacing spark plug number four, you need to take care. The plugs sit at



6 The post-cat sensor is positioned low down towards the bottom of the power unit – the connector plug/socket assembly is being indicated in the photo. Check the sensor and the cable and connector.

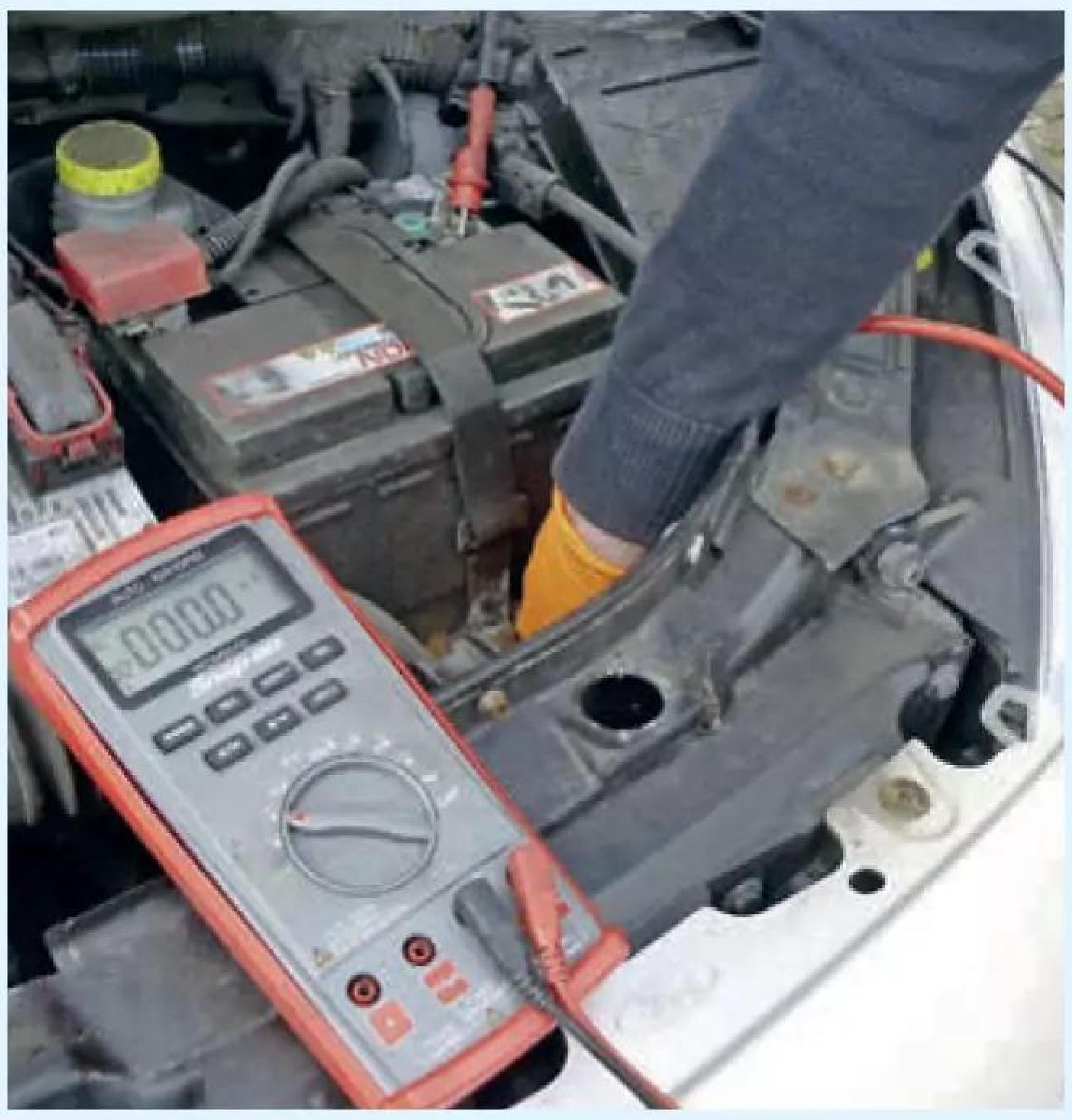


7 Adjacent to and just to the right of the battery is the ECU. It is held in place by four nuts (10mm spanner size) and features two connector plug assemblies. Check for moisture ingress, physical deterioration and connection security.

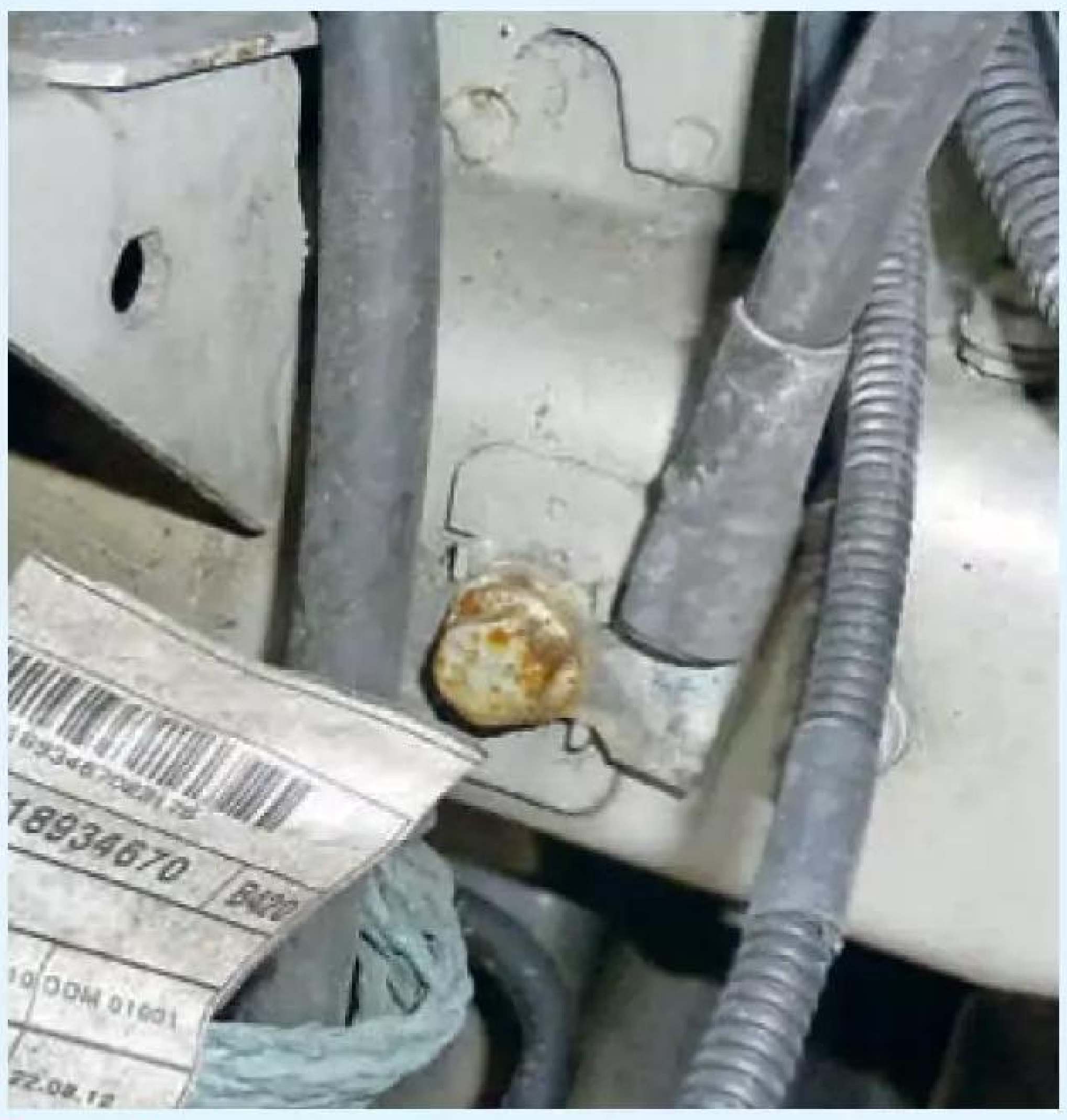


8 The throttle body assembly is located at the top of the engine, towards the rear of the engine bay. If internal cleaning of the assembly and its operating flap is required, use purpose-made cleaner and apply it carefully using a soft brush.

9 The conventional lead-acid battery needs to be in tip-top condition. Check that the cables and connectors are clean and securely attached. If the battery retaining clamp assembly is corroded, it is wise to remove and clean the clamp and lubricate its threads.



10 A useful test is to use a multimeter to check for any voltage drop between the battery earth terminal and the vehicle body. Any increase in voltage indicates corrosion or deterioration in the cable or its connections.



11 There's a vital earth connection point on the inner wing panel on the left-hand side of the engine bay. Ensure the connection is clean and secure. If in doubt, dismantle the joint, clean and reassemble it, then coat it with silicone grease.

a slight angle and can be tight. When taking out number four it has been known for the spanner to slip or jolt and break the corresponding fuel injector.

Fault 5

FRONT SUSPENSION STRUT TOP CORROSION

This fault does not involve electronics. When working under the bonnet it is worth inspecting the strut top assembly on the driver's side of the car. You will notice that it sits directly below the scuttle, so rainwater runs onto it and sits in the bowl with the top strut nut, eventually corroding it badly. Serious corrosion here can make the job of changing the struts/springs horrendous if the nut has seized.

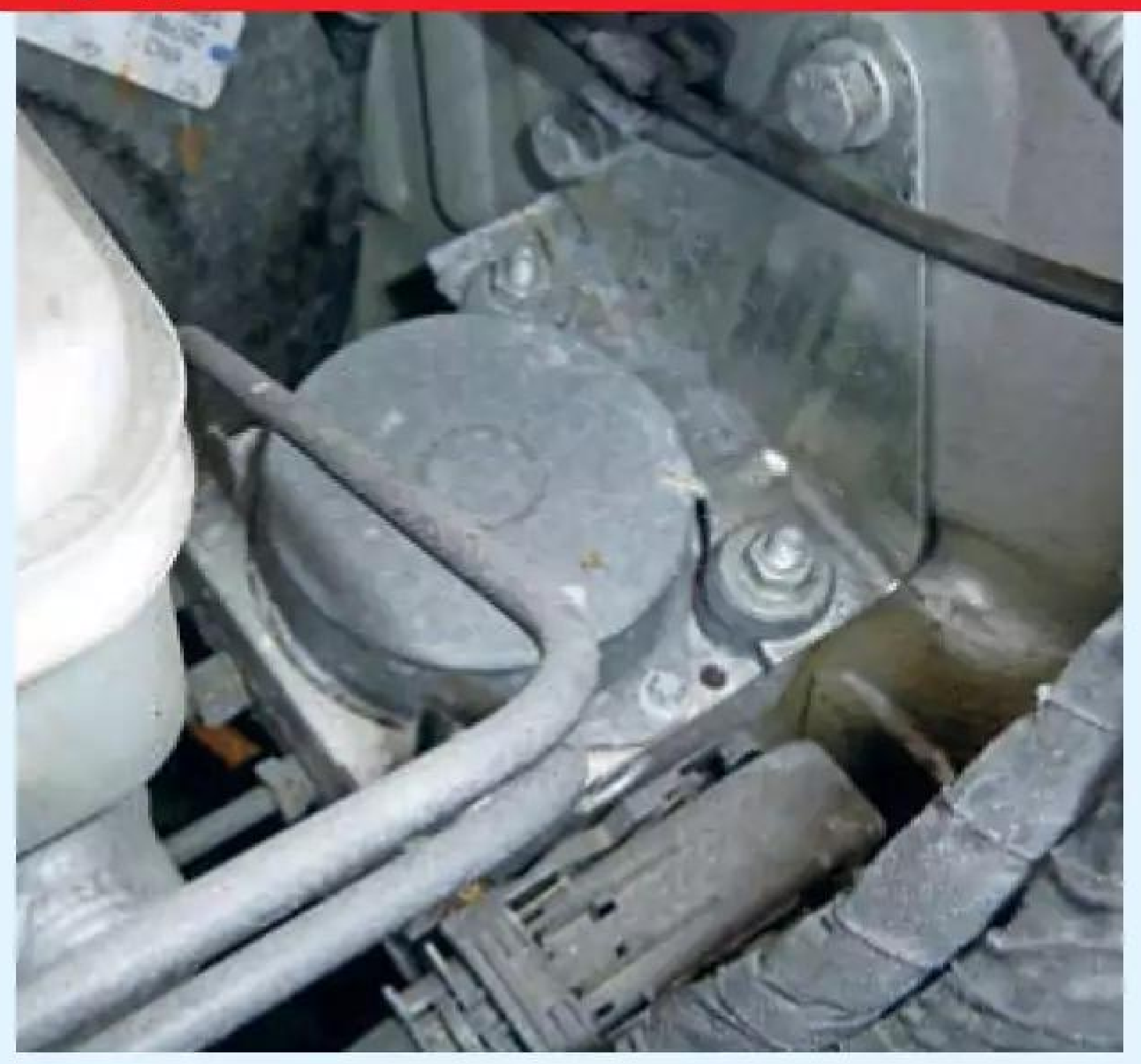
Whenever servicing a Ka, dry out any pooling water and apply a good coating of grease and/or fit a plastic cap.

Technical Specs

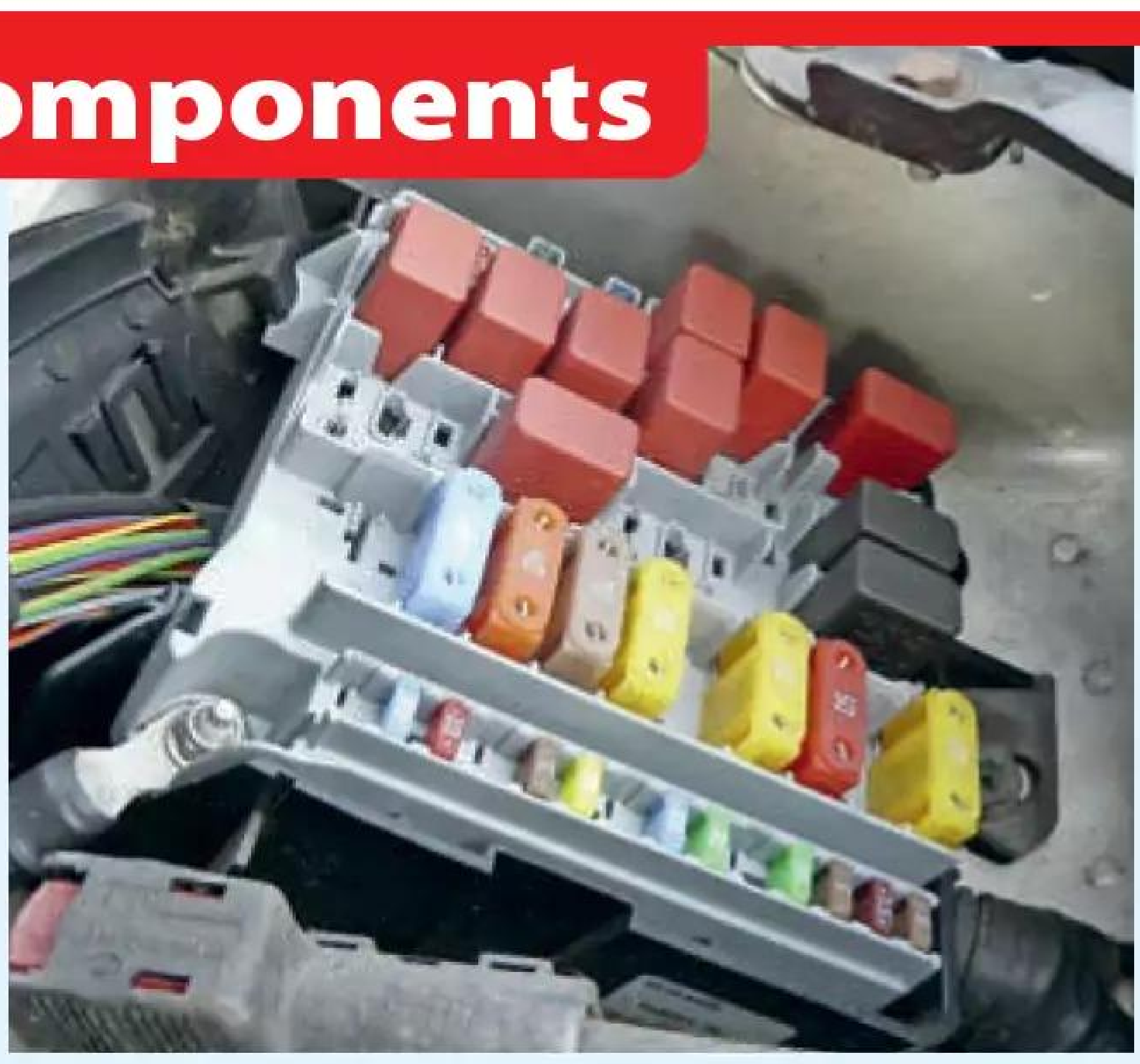
Actual values

Component	Value
Fuel injector	15 ohms
Cam sensor supply voltage	5 volts
Cam sensor signal	0-5 volts switching
Oxygen sensor heater circuit	7.2 ohms
Ignition coil primary resistance	0.8 ohms

Typical Ford Ka II components

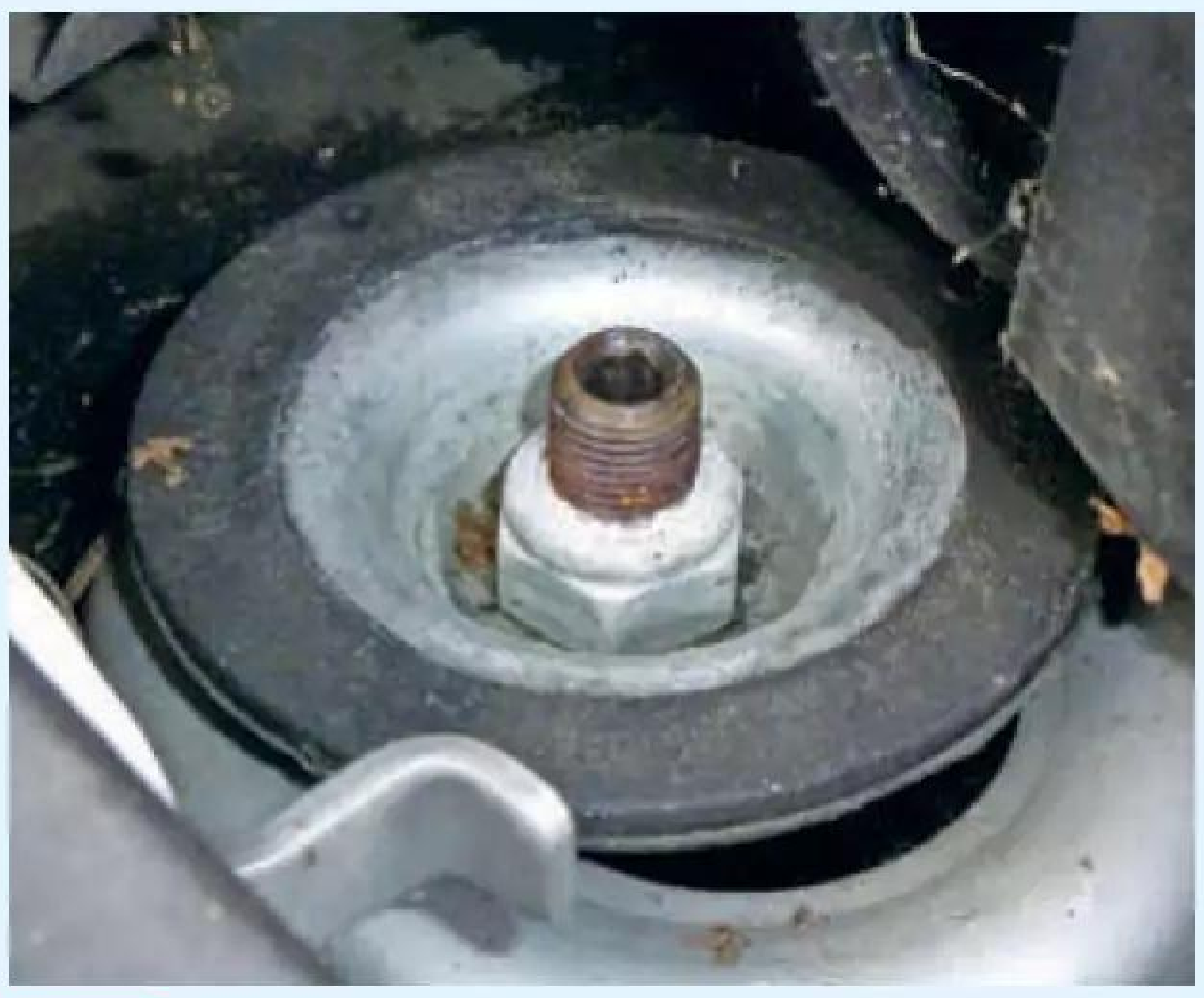


12 The ABS pump and its ECU. Regular/frequent visual inspection is advised as the ECU is exposed to heat and vibration in its vulnerable underbonnet location.

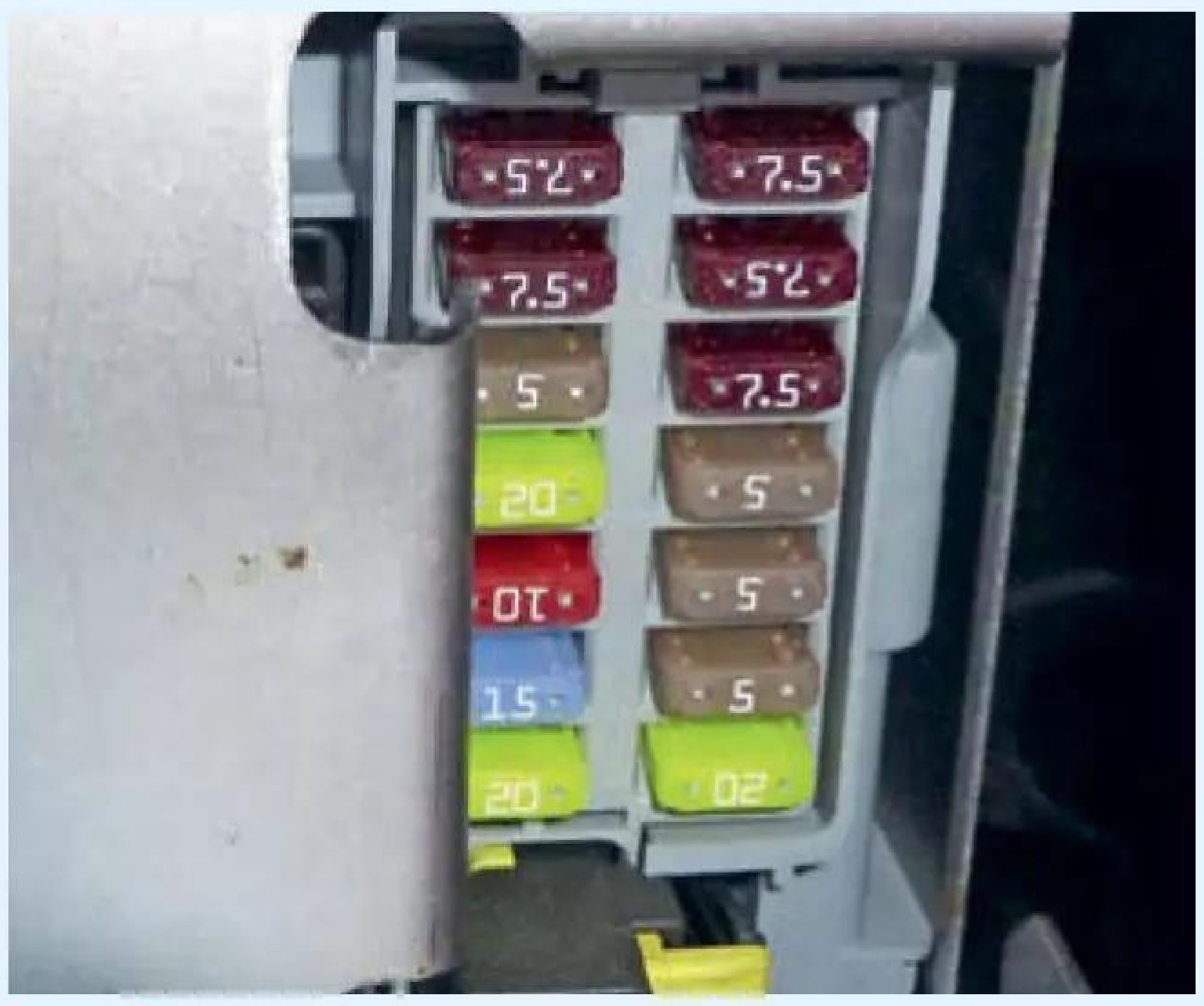


13 The underbonnet fuse/relay box is found on the left-hand side of the engine compartment, adjacent to the inner wing and towards the rear. Check carefully for any signs of moisture ingress, which will play havoc with the circuitry.

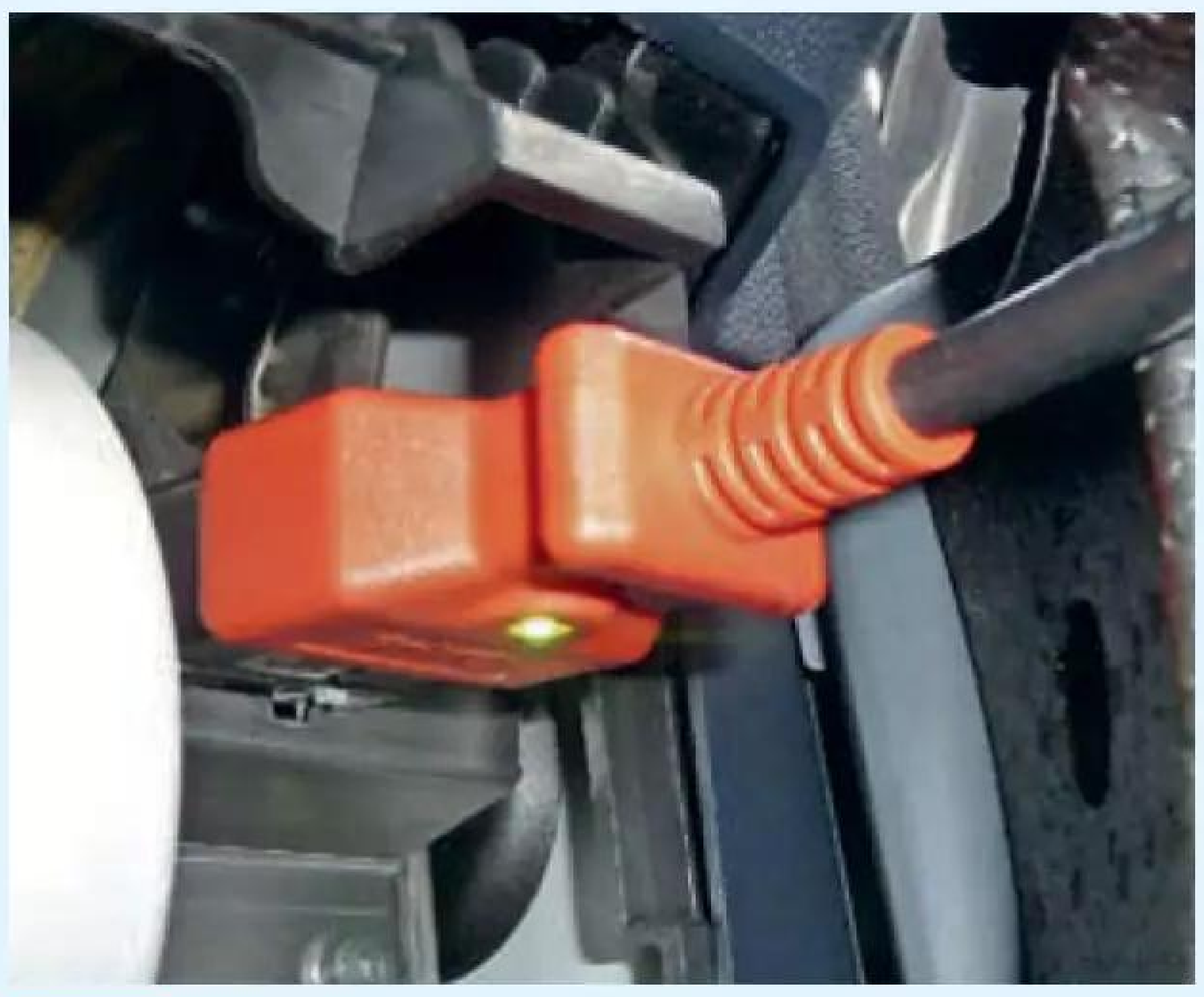
14 When refitting the plastic cover to the fuse/relay box, it is essential to correctly engage the two locating lugs built into the cover on the bulkhead side. Failure to do this may result in rainwater getting into the box.



15 While not part of our electronic diagnostics procedure, we recommend that, at each service, you should remove the plastic caps from the strut tops and apply grease to the strut top threads, because corrosion is common here.



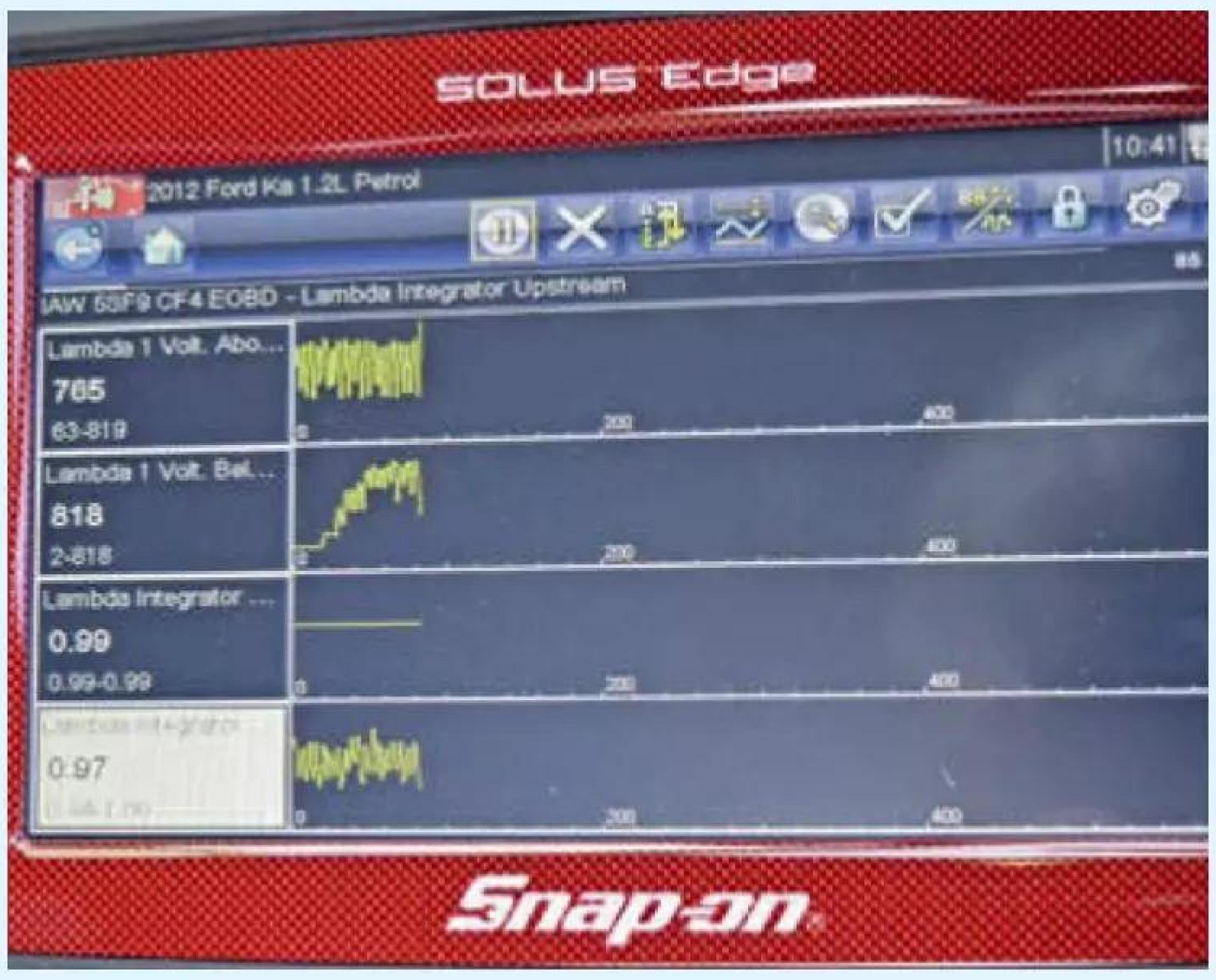
16 Normally hidden by a plastic cover panel is the car's interior fusebox, located on the left-hand side of the fascia. Check it for cleanliness and security, and watch for any signs of water ingress.



17 The diagnostic socket is located on the right-hand side of the fascia and, when not in use, it is concealed by a plastic cover panel. Here, the connecting cable of the Snap-on SOLUS Edge tool is in place for diagnostic interrogation.

18 ◀ Here, we are ready to use the SOLUS Edge equipment to give a full health check on the vehicle. The tool is capable of providing the operator with a wealth of information, including live data, about the management system.

19 ▶ This screenshot of the SOLUS Edge is showing live data relating to oxygen/O2/Lambda sensor operation. The ability to see live data like this is invaluable in a wide range of diagnostic tests to establish how well the car is running.



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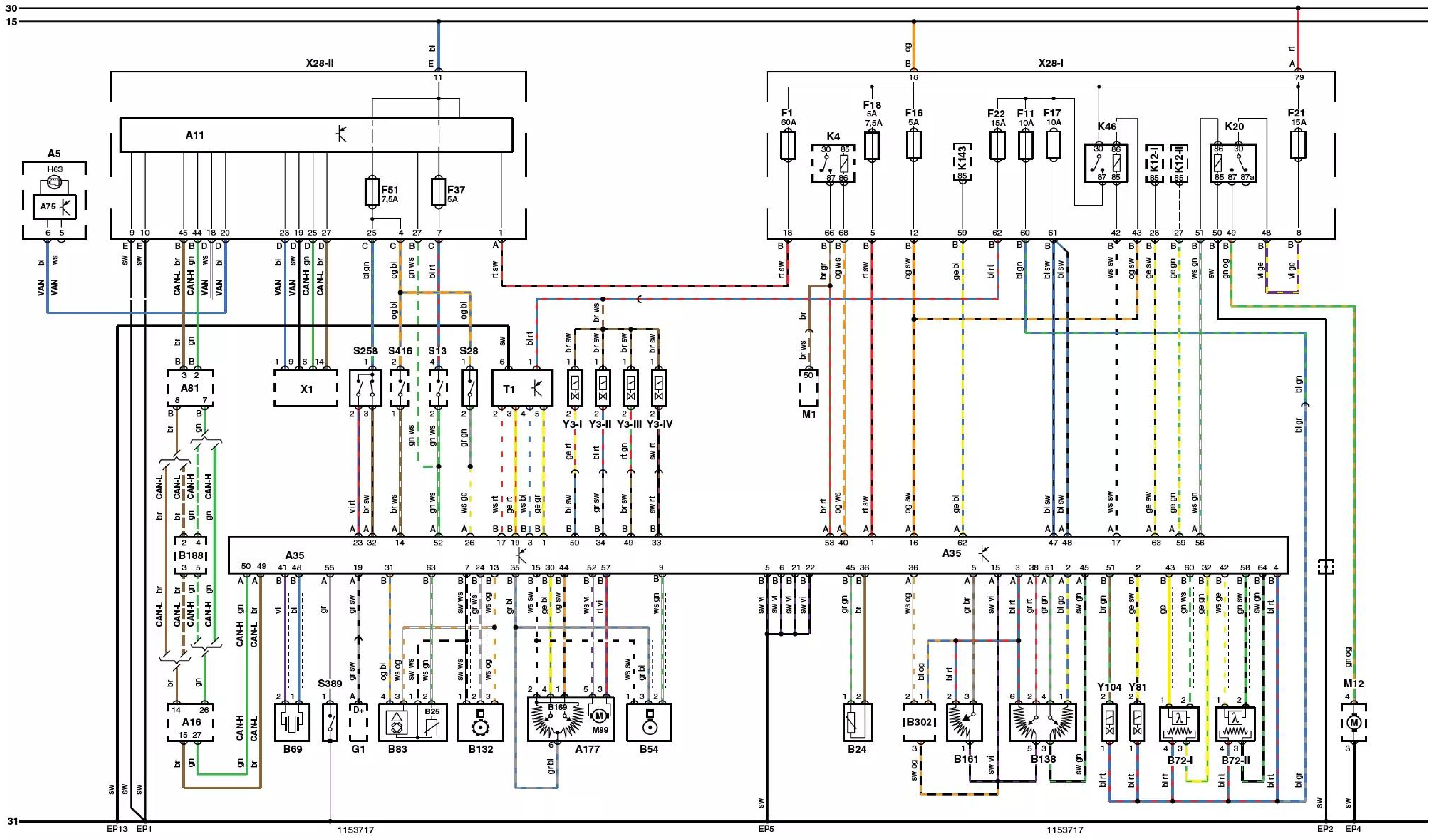
MAGNETI MARELLI CIRCUIT DIAGRAM


30
15
X28-II
X28-I
A5
H63
A75
A11
F51 7,5A
F37 5A
F1 60A
K4
F18 5A 7,5A
F16 5A
K143
F22 15A
F11 10A
F17 10A
K46
K12-I
K12-II
K20
F21 15A
VAN
CAN-L
CAN-H
S258
S416
S13
S28
X1
T1
Y3-I
Y3-II
Y3-III
Y3-IV
M1
A81
B188
A35
A16
S389
B69
G1
B83
B25
B132
B169
M89
A177
B54
B24
B302
B161
B138
Y104
Y81
B72-I
B72-II
M12
31
EP13
EP1
EP5
EP2
EP4
1153717

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A16	ABS CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A75	INSTRUMENTATION CONTROL MODULE
A81	POWER STEERING CONTROL MODULE
A177	THROTTLE CONTROL UNIT
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B69	KNOCK SENSOR (KS)
B72-I	HEATED OXYGEN SENSOR (HO2S) | **1**
B72-II	HEATED OXYGEN SENSOR (HO2S) | **2**
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
B188	YAW RATE SENSOR
B302	NEUTRAL POSITION (NP) SENSOR
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
EP	EARTH POINT
F	FUSE
G1	ALTERNATOR
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K4	STARTER MOTOR RELAY
K12-I	ENGINE COOLANT BLOWER MOTOR RELAY | **1**
K12-II	ENGINE COOLANT BLOWER MOTOR RELAY | **2**
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
M1	STARTER MOTOR
M12	FUEL PUMP (FP)
M89	THROTTLE MOTOR
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S28	REVERSE GEAR POSITION SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S389	ENGINE OIL PRESSURE SWITCH
S416	BRAKE SERVO VACUUM PUMP SWITCH
T1	IGNITION COIL
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X28-I	FUSEBOX/RELAY PLATE, ENGINE BAY | **1**
X28-II	FUSEBOX/RELAY PLATE, ENGINE BAY | **2**
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y3-IV	INJECTOR | **4**
Y81	CAMSHAFT POSITION (CMP) ACTUATOR
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
15	IGNITION SWITCH – IGNITION ON
30	BATTERY +
31	BATTERY –

USEFUL PREPARATION DATA

Service intervals Officially every 12,500 miles or 12 months, whichever comes first. It is beneficial to service the vehicle and renew the engine oil and filter at least twice as frequently.

Cambelt At least every 62,500 miles or five years. **Air filter** Every 37,500 miles or three years.

Spark plugs NGK ZKR7A-10 or equivalent; renew every 25,000 miles or two years.

Valve clearances Check and reset every 37,500 miles or three years. Clearances: inlet, 0.30-0.40mm; exhaust 0.40-0.50mm.

ENGINE OIL

Oil type SAE 5W-40 fully-synthetic to API/ACEA SM/C3 and Ford specification.

Capacity (service fill) 2.8 litres. **Sump plug torque setting** 20Nm. **Brake fluid** Change every two years.

Electronic Diagnostics

PROTON SAVVY 1.2

Tracing and fixing faults in electronic engine management systems

When new, Proton's Savvy was a well-equipped, affordable hatchback, and used examples are very cost-effective vehicles today. **Kim Henson** and **Edward Haggar** lift the diagnostic lid on a 2009 example.

The Malaysian-built Savvy was Proton's 'supermini' five-door hatchback, produced from 2005 until 2011, with a facelift in 2007. It was sold in many countries around the world, including the UK, and was particularly popular in its home country.

Although the car was Malaysian-designed and developed, mechanically-speaking it owed much to the contemporary Renault Clio, and was powered by a 16-valve 1.2-litre twin-overhead camshaft four-cylinder engine (D4F Type), also used in the Renault Twingo as well as the Clio.

This is good news for owners, as this Renault engine (and its ancillary components) is essentially easy to maintain. It should also be mentioned that Protons sold in the UK, including the Savvy, were especially well protected from new by anti-rust treatments, and checking the state of the protective coatings formed part of the dealer service schedule.

NOTE: All references in our text and captions to 'left' and 'right' sides are from the point of view of someone sitting in the car and looking ahead.

The car featured in our photographs is a well-cared for, low mileage, pristine-condition 2009 example. Our guide to the diagnostic aspects of our Proton's 1.2-litre petrol engine is Edward Haggar.

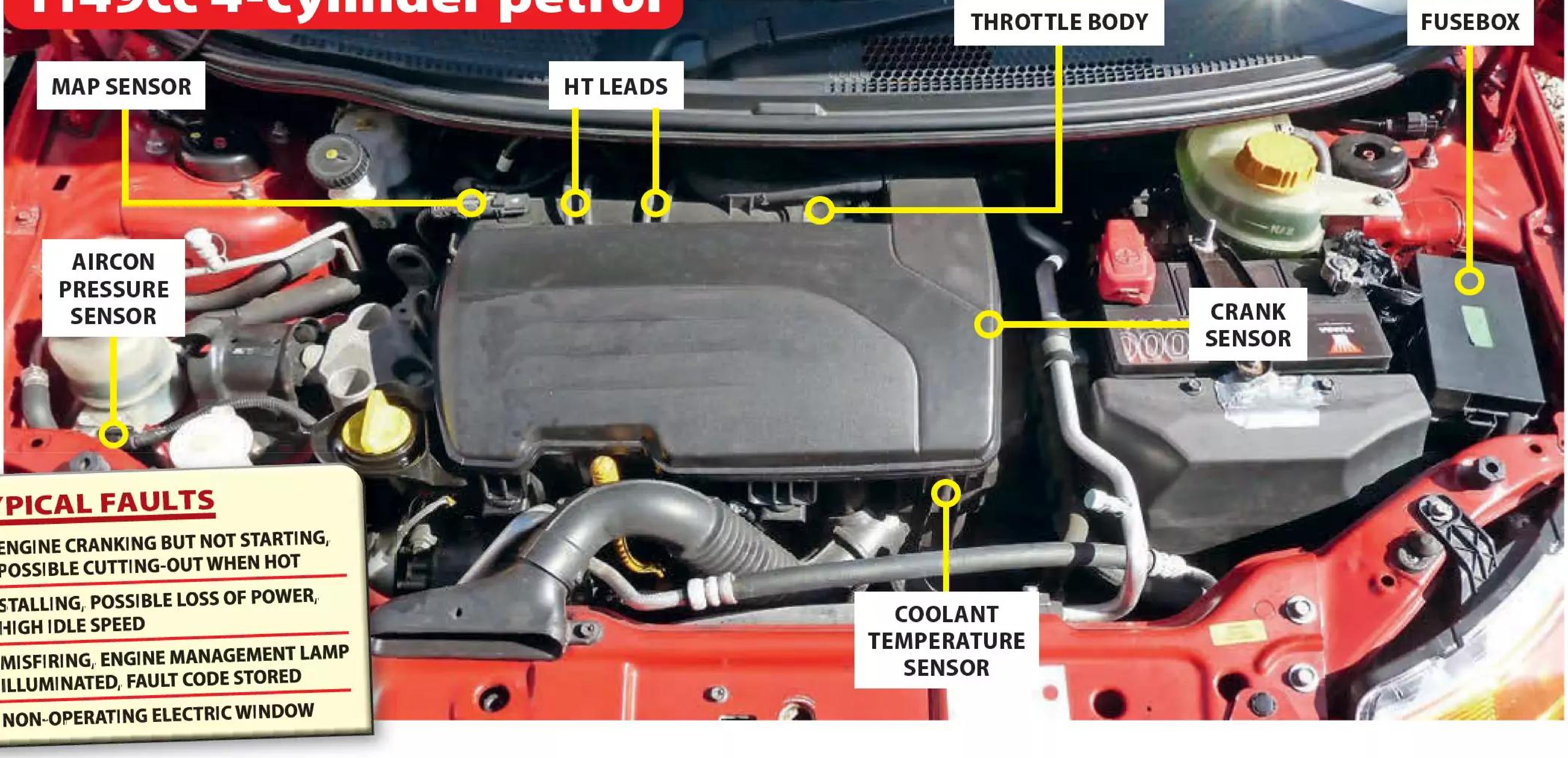
Preparation

Available space in the engine bay is reasonably generous for a compact, front-wheel-drive car, and the Savvy is easy to service. Even changing a timing belt is a job that can be tackled with confidence by a home mechanic. Long-term reliability is helped by frequently changing the engine oil and filter, and by using the engine oil specified by Proton.

One potential problem area is the under-bonnet wiring and connections; as with Renaults of the same era, these aspects are known to be relatively fragile, so keep an eye out for failings. However, don't let this put you off because overall the Savvy is a good proposition for maintenance and carrying out diagnostic work at home.

Not shown in our photo sequence is the battery, but you ought to check its security and condition, and examine its cables and their connections for signs of rust. If corrosion is evident on the connectors, remove and clean them, and re-assemble using protective silicone

1149cc 4-cylinder petrol



TYPICAL FAULTS

① ENGINE CRANKING BUT NOT STARTING, POSSIBLE CUTTING-OUT WHEN HOT

② STALLING, POSSIBLE LOSS OF POWER, HIGH IDLE SPEED

③ MISFIRING, ENGINE MANAGEMENT LAMP ILLUMINATED, FAULT CODE STORED

④ NON-OPERATING ELECTRIC WINDOW

ENGINE MANAGEMENT

The management system used on the Proton Savvy incorporates these primary components:

- Multi-plug ECU.
- Ignition coil incorporating HT leads.
- Inductive crankshaft sensor.
- MAP sensor.
- Four solenoid type fuel injectors.
- Pre- and post-catalyst oxygen sensors.
- Throttle body incorporating throttle position sensor.
- Brake pedal position sensor, fitted to pedal.
- Coolant sensor.
- Fuel pump in tank.
- Standard traditional lead-acid type battery.
- Adjustable tappets.

grease to protect against moisture penetration. Even if they are not (yet) corroded, a light coating of this grease is a good preventive measure.

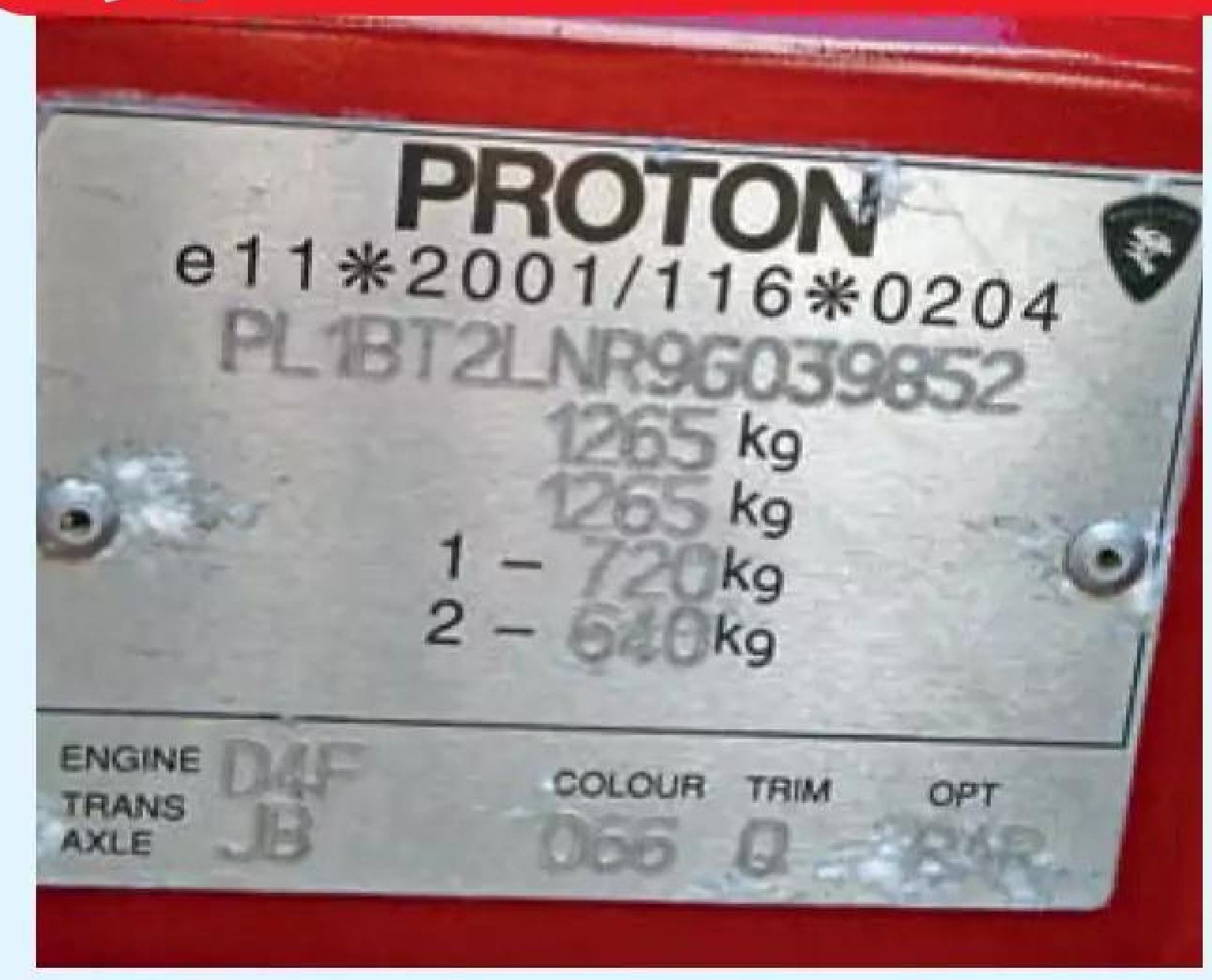
If ever required, renewing the alternator and starter motor are do-it-yourself jobs. Changing a clutch is not quite so straightforward as the front subframe has to be lowered to provide access.

From a diagnostic point of view you might struggle to find a Proton menu option within the equipment or software you are using, but selecting and entering the equivalent Renault Clio engine details should get you into the system and able to interrogate your Savvy.

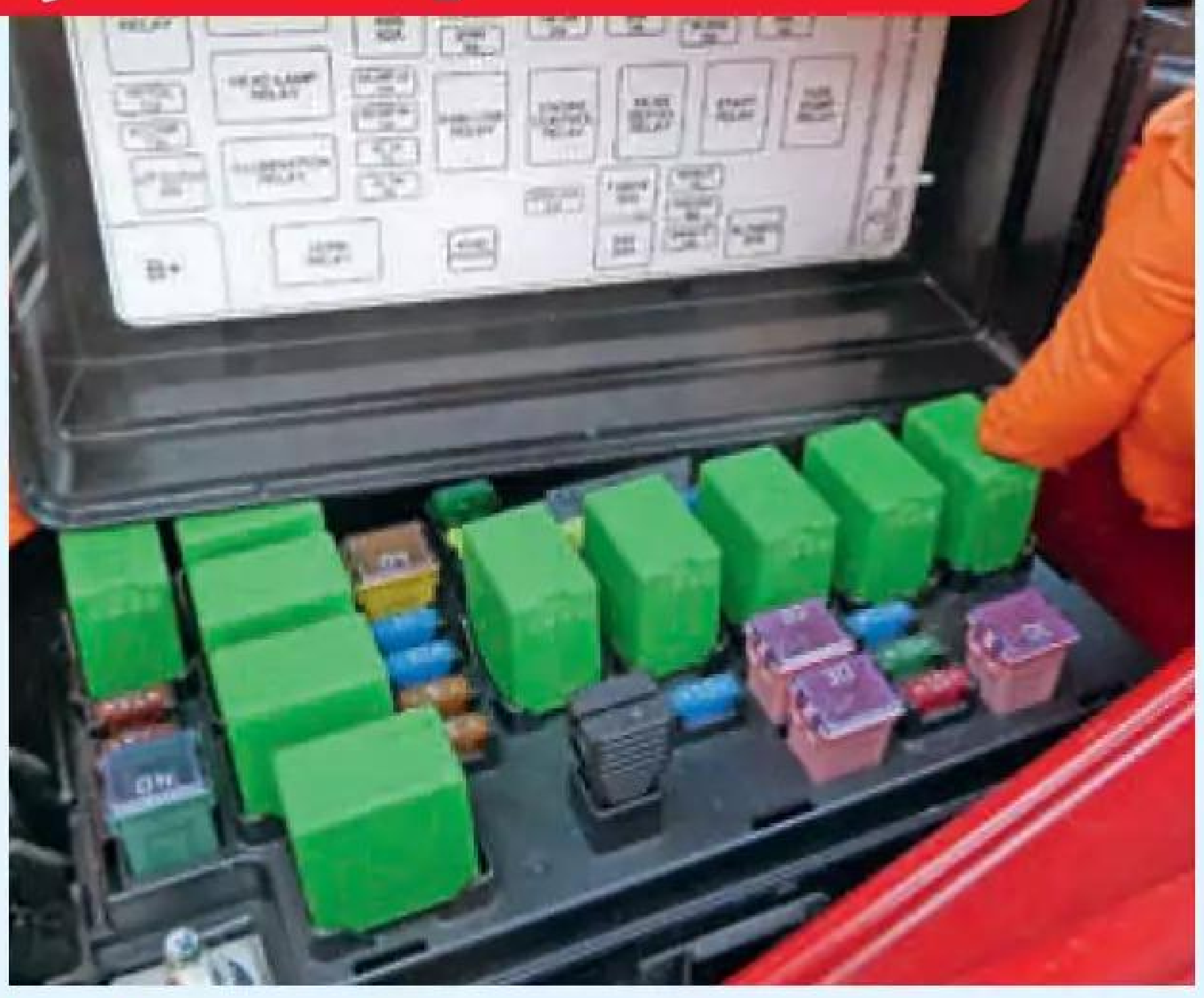
Unusually, but helpfully, the Savvy features a dash-mounted button to enable easy programming of the car's key assemblies. The procedure is:

- Turn on the ignition.
- Press and hold the reset button on the dash; keep it depressed.
- While still pressing the reset button, turn the ignition switch to the 'off' position and remove the key.
- Re-insert the key and turn on ignition.
- Now release the reset button on the dash.
- While the key is still in the ignition lock, press either the lock or unlock button on the fob.
- You should now hear a beep, the red immobiliser LED lamp will flash, and the doors will lock.
- Now using the second key fob, press a button and you should hear a 'beep' sound, the red immobiliser lamp will flash and the doors will lock.
- Switch off the ignition.

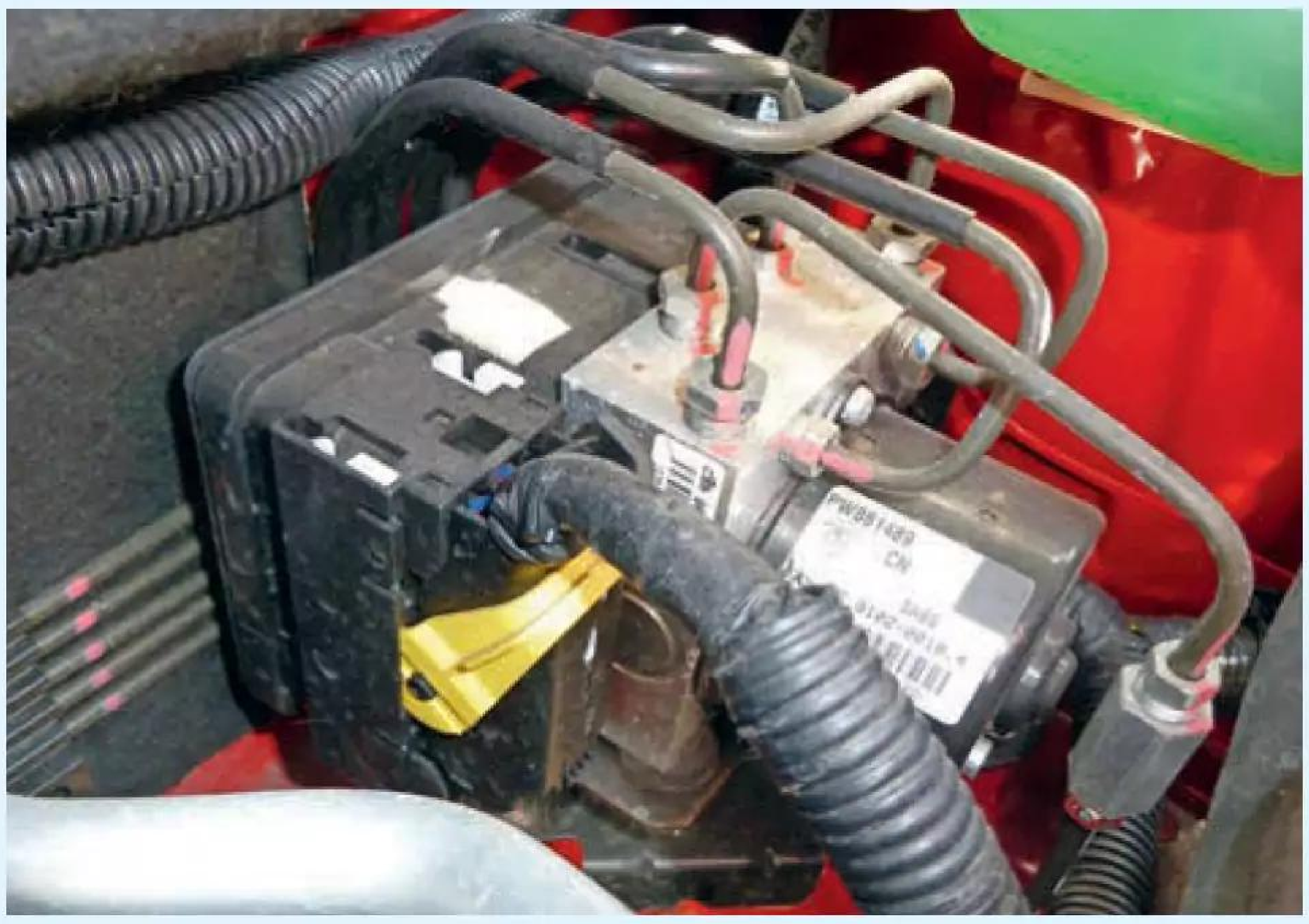
Typical Proton Savvy components



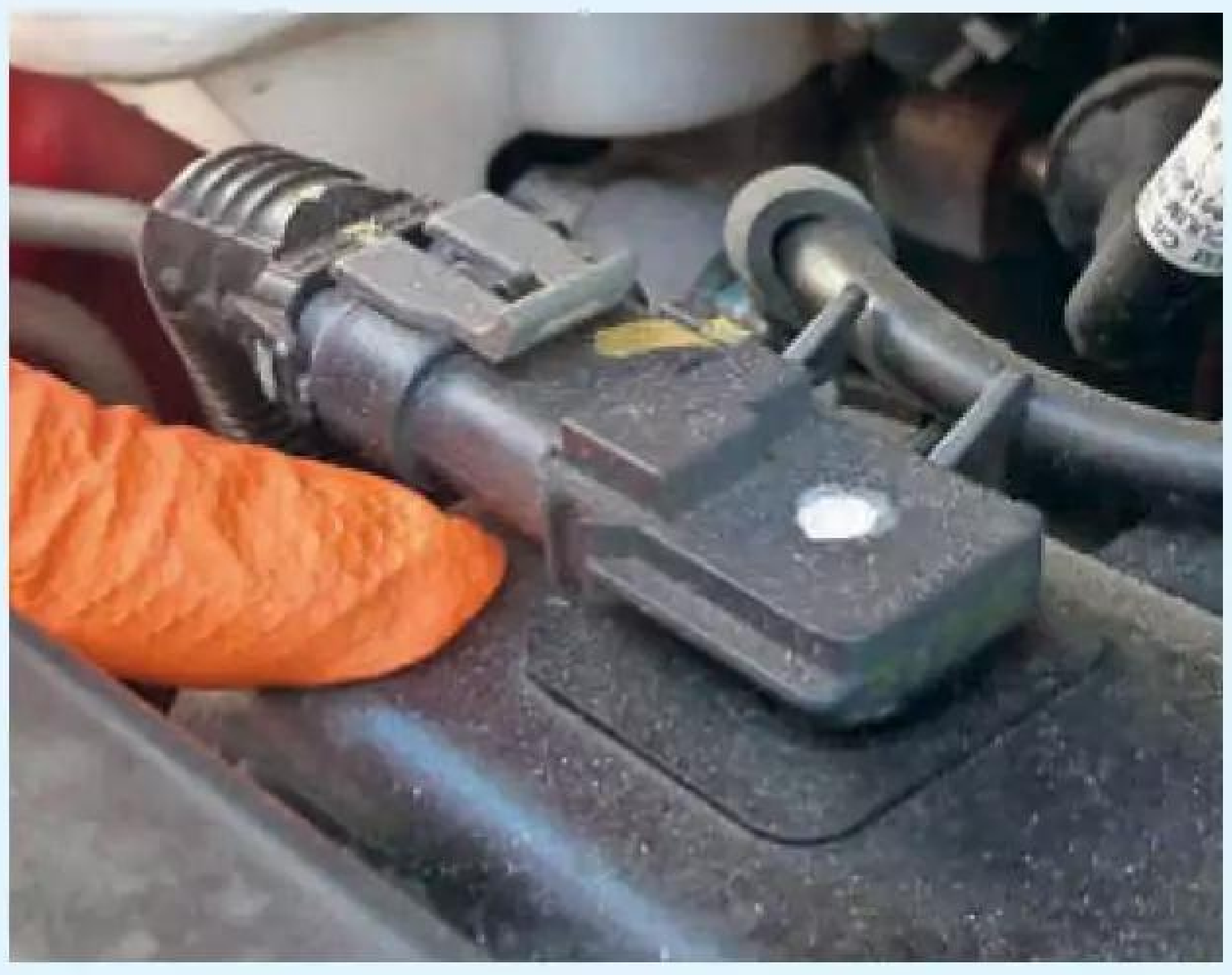
1 On the right-hand central door pillar (B-post) is an identification plate, which provides important information about the vehicle, including the engine – Type D4F. This plate is also helpful in confirming the original transmission, paint colour and trim details.



2 The under-bonnet fuse and relay box is located just ahead of the left-hand suspension turret, outboard of the battery (not shown). Component locations are helpfully identified on the underside of the fusebox lid. Here, Edward is identifying the fuel pump relay.



3 ◄ Tucked away at the rear of the engine compartment is the ABS system ECU assembly, incorporating the system pump. Ensure that the wiring, electrical connections and all fluid pipes are sound and secure.



4 The Mass Absolute Pressure (MAP) sensor is located within the inlet manifold housing. Its job is to signal to the ECU the actual pressure within the manifold at any given moment, this being one of the factors enabling the ECU to determine correct fuelling levels.

5 Hidden away right at the back of the engine, on the right-hand side, is the connector plug assembly for the coil pack. Note that on this engine the high-tension leads form part of the coil assembly. Check for cleanliness, condition and security of the connector plug.

USEFUL DATA

Below are the official replacement intervals for the various components. However, we recommend that these are at least halved.

Service intervals: Officially 12,000 miles or 12 months, whichever comes first.
Oil Type: SAE 10W-40, semi-synthetic – use only the recommended specification oil.
Capacity (service fill): 3.8 litres. **Sump plug torque setting:** 25Nm.
Oil filter torque setting: 10Nm. **Brake fluid:** Every two years.
Cambelt: Renew at least every 60,000 miles or 60 months. **Air filter:** 48,000 miles.
Spark plugs: Champion REA8MCL or equivalent; renew every 24,000 miles.

Fault 1:

FAILING CRANKSHAFT POSITION SENSOR

When our first fault arises, the engine may crank but refuse to start, and/or it may cut out when hot. The failure lies with the crank sensor connector.

If you are presented with a non-start situation, a quick check here is to watch the rev counter and look for any movement of the needle whilst cranking the engine; this can be a quick check to see if a signal is present. If no signal is evident, move on to the crank sensor – usually if you wiggle the crank sensor connector the engine will now start.

The problem is caused by high resistance within the crank sensor connection. The fix is to fit a new crank sensor, with a modified loom that you cut and join. If you struggle to find the parts remember this is a Renault Clio D4F engine so ask your local parts factors to look up the parts via this application.

The crank sensor location is just above the bellhousing in the centre. A slight word of caution: remember when fitting the modified loom that you need to join the wires thoroughly, with solder or careful connections. Edward says that he has known these joins to cause strange issues if not effected correctly.

Fault 2:

DIRTY/CONTAMINATED THROTTLE BODY

If the engine stalls and loss of power is evident, possibly accompanied by a tickover speed that is too high at idle – also when the engine is revved the rpm level might stick slightly – the problem is a gummed-up throttle body. This causes the throttle plate to not seat properly, hence the possible 'sticking' of the engine revs at too high a level.

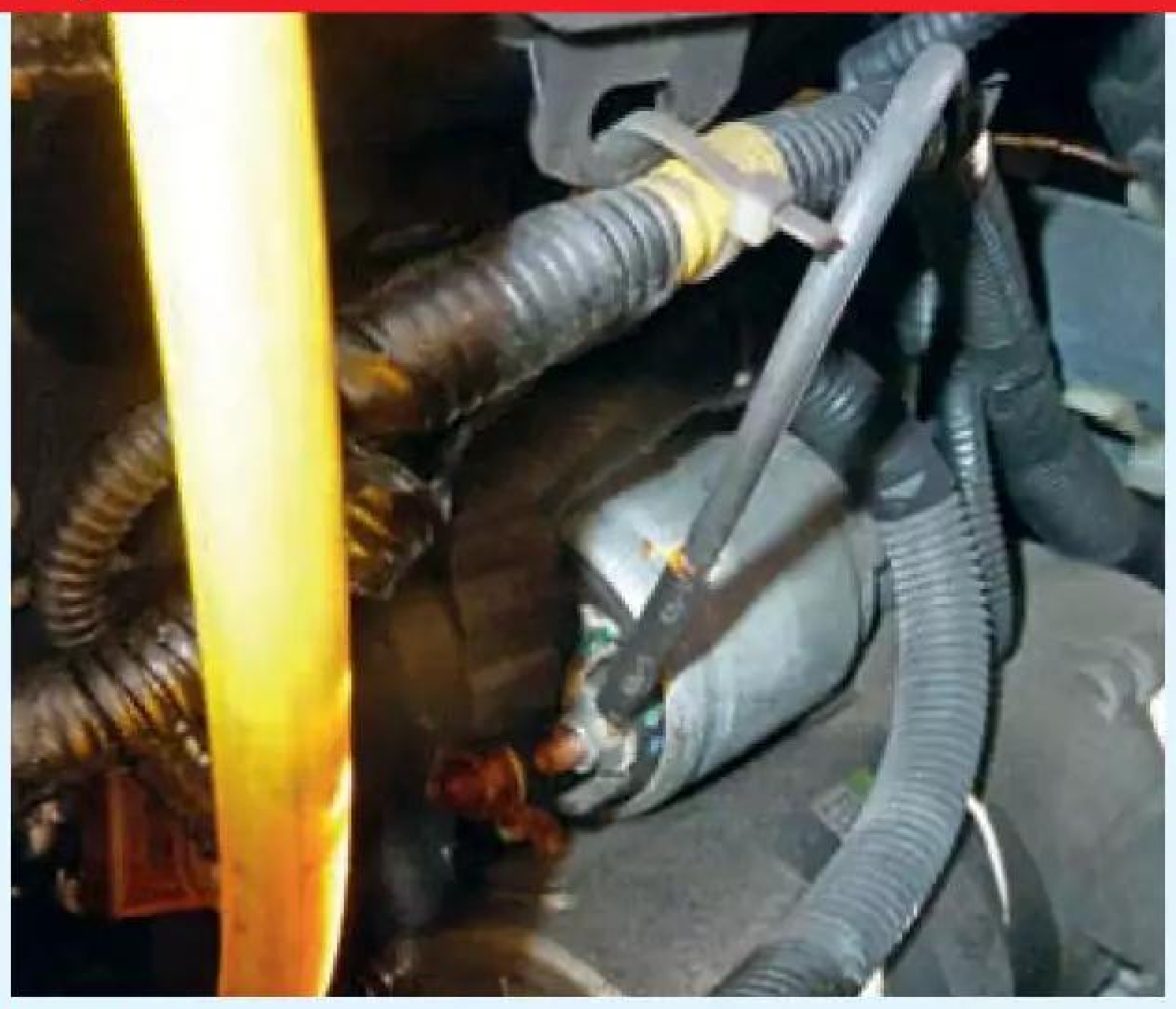
From a diagnostic point of view there are different ways to go about identifying and sorting the problem. You could connect a tester and, via live data, look at the throttle position signal, to check for a good signal. However, Edward prefers to remove and clean the throttle body assembly regardless, as part of his investigation, using a suitable throttle body cleaner. It doesn't do it any harm to carry out such cleaning at every major service.

Fault 3:

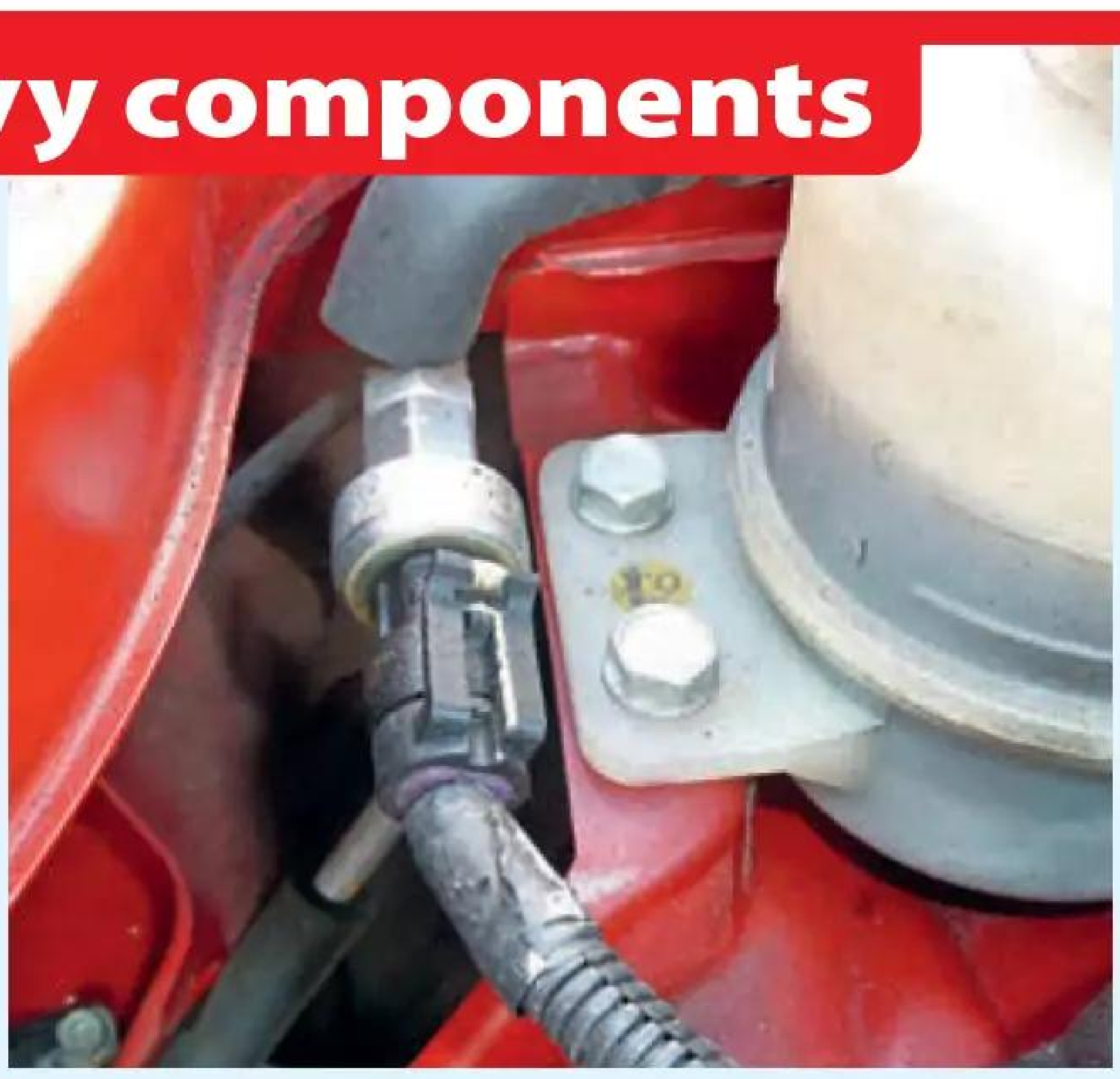
IGNITION COIL OR SPARK PLUG AILMENTS

When this fault occurs the engine will misfire, and the engine management system warning light on the dash will

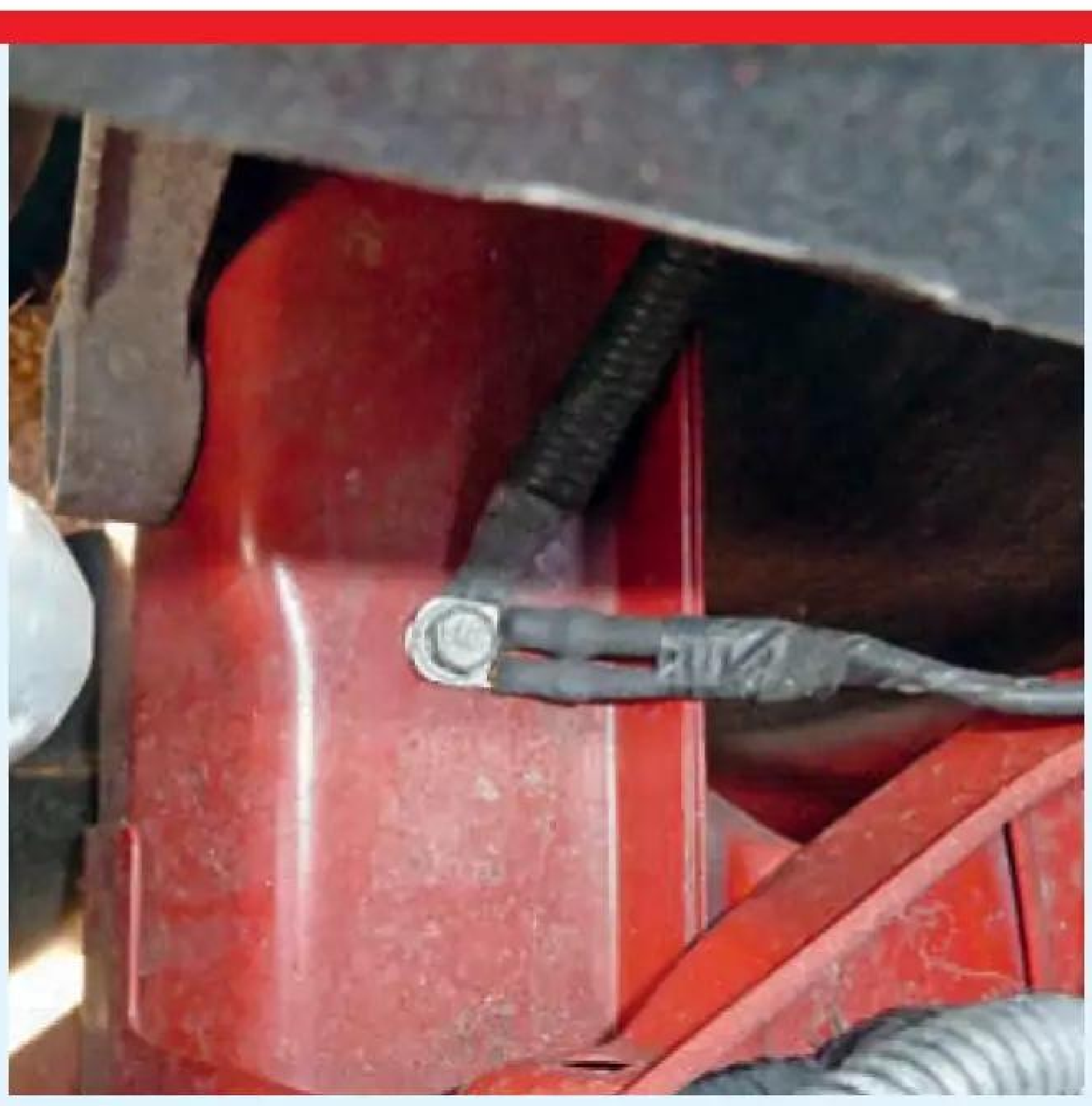
Typical Proton Savvy components



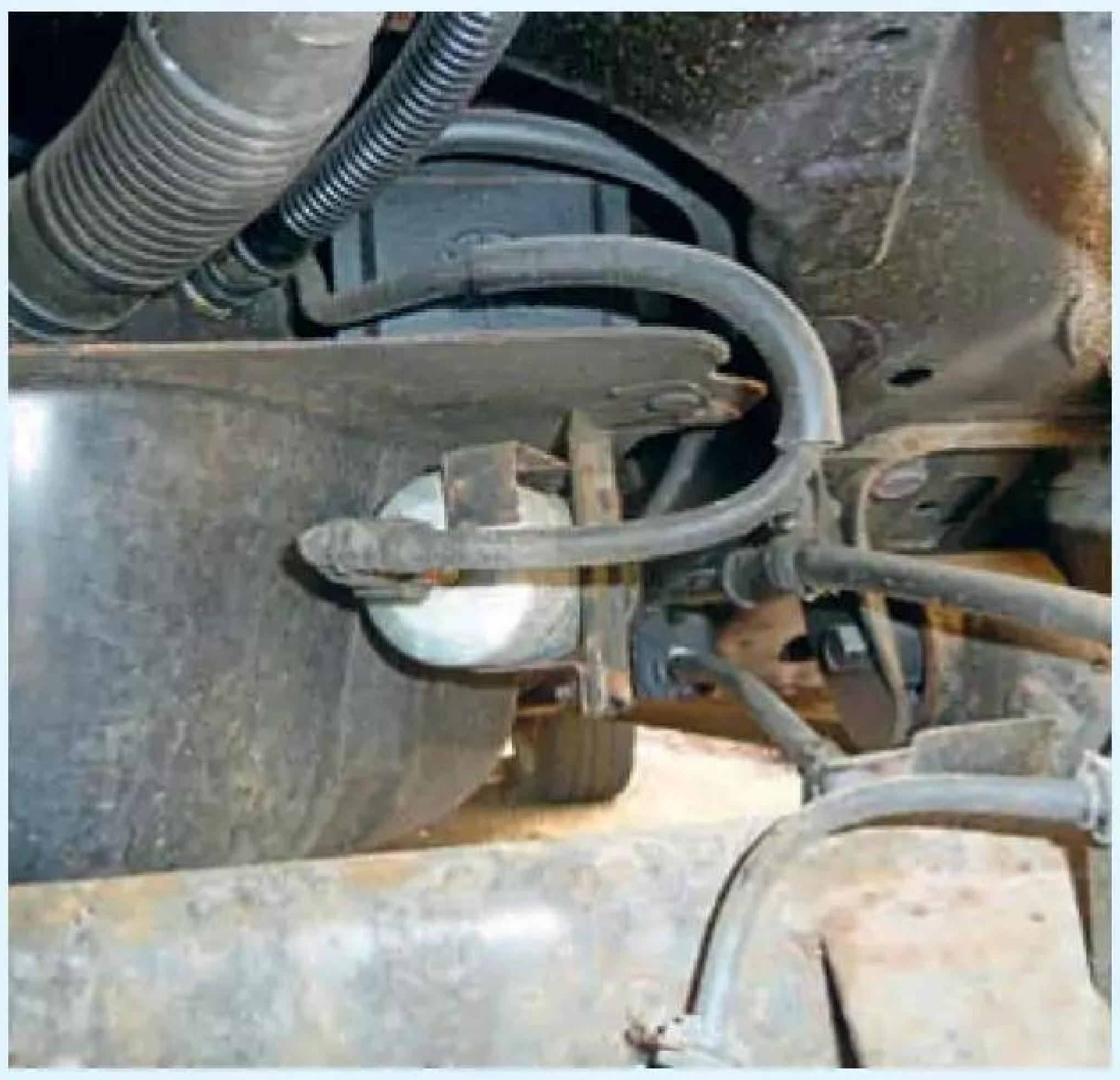
6 Buried at the front of the engine, close to the engine oil dipstick tube, is the starter motor (access space for our camera was extremely limited). Check for clean, secure electrical connections, and note that this area is easier to reach by hand than it is to see.



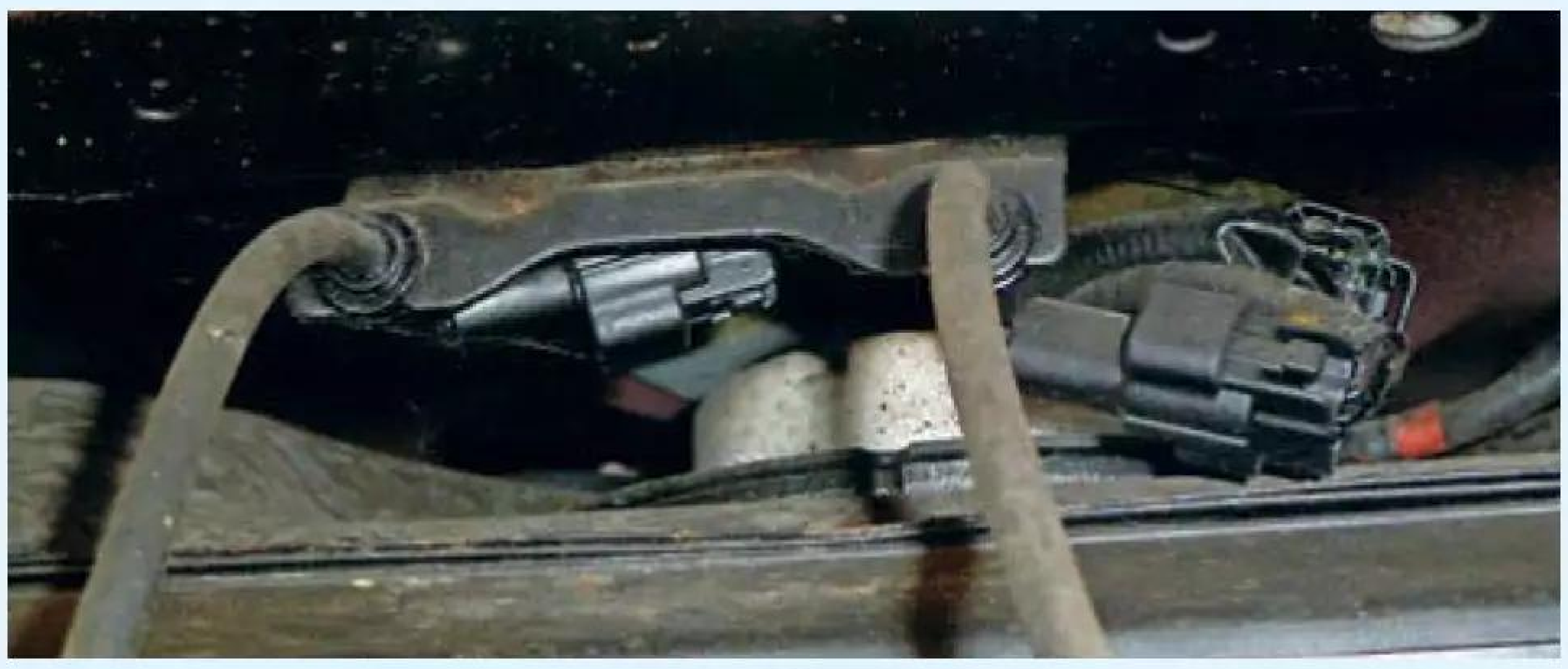
7 On the right-hand side, ahead of the suspension turret, is the air-conditioning system pressure switch; check for security, condition and possible leaks. The sensor tells the ECU the pressure within the aircon system. Low pressure will trigger a 'fail safe' mode and the pump won't be switched on.



8 This important earth point is found on the left-hand inner wing assembly. Make sure that the connection is secure and clean. If in any doubt, dismantle the joint, clean and re-assemble, protecting the connection using silicone grease (which is waterproof).



9 Don't ignore the fuel filter, which is located beneath the rear of the car, on a bracket adjacent to the petrol tank. Renew the filter at least as often as recommended by Proton (and preferably twice as frequently), and always check for leaks on completion of the job.



10 ◀ The rear sensor connectors for the anti-lock brake system (ABS) are positioned under the car, above the fuel tank, where they are often ignored. Make a point of inspecting them for any signs of moisture ingress and deterioration.

11 ▶ The underbody of the Savvy (and other Proton models) was undersealed when new, but check often to ensure the coating is still doing its job. This image also shows the exhaust system, including the post-catalyst oxygen/Lambda sensor.

illuminate. Connection using a tester will present a 'P' code, with reference to a cylinder misfire. For example, P0301 means that cylinder No.1 has the problem (P0302 denotes cylinder No.2, etc.). In this situation the car will be virtually undriveable.

A quick and effective test can be to connect a spark plug to the offending cylinder and rest it against an earth point, while – with the aid of a second person cranking the engine on the starter motor – checking for a spark. Obviously the coil can be also tested with the aid of an oscilloscope, but this spark plug test does the job without the need for special or costly equipment.

Edward has also known misfires to be caused by the spark plug tubes being full of water, so check this aspect too.

It is worth noting that this engine uses a coil and HT lead 'all as one' ignition system. As always, installing new spark plugs at the same time as renewing other ignition parts is a must, and do replace components with high quality items.

Fault 4:

ELECTRIC WINDOW MOTOR PROBLEM

If you ever have an issue with an electrically-operated window not working, it's highly likely that this is due to a motor fault. You can simply remove the door trim panel and apply 12 volts either side of the motor to check its function.

This problem is very common, but rectification isn't always as easy as you might imagine. The trouble is that the parts concerned are not Renault-sourced, but Proton's own. Obtaining the new component required is now almost impossible. It is likely that you will have to search scrapyards or online sources.

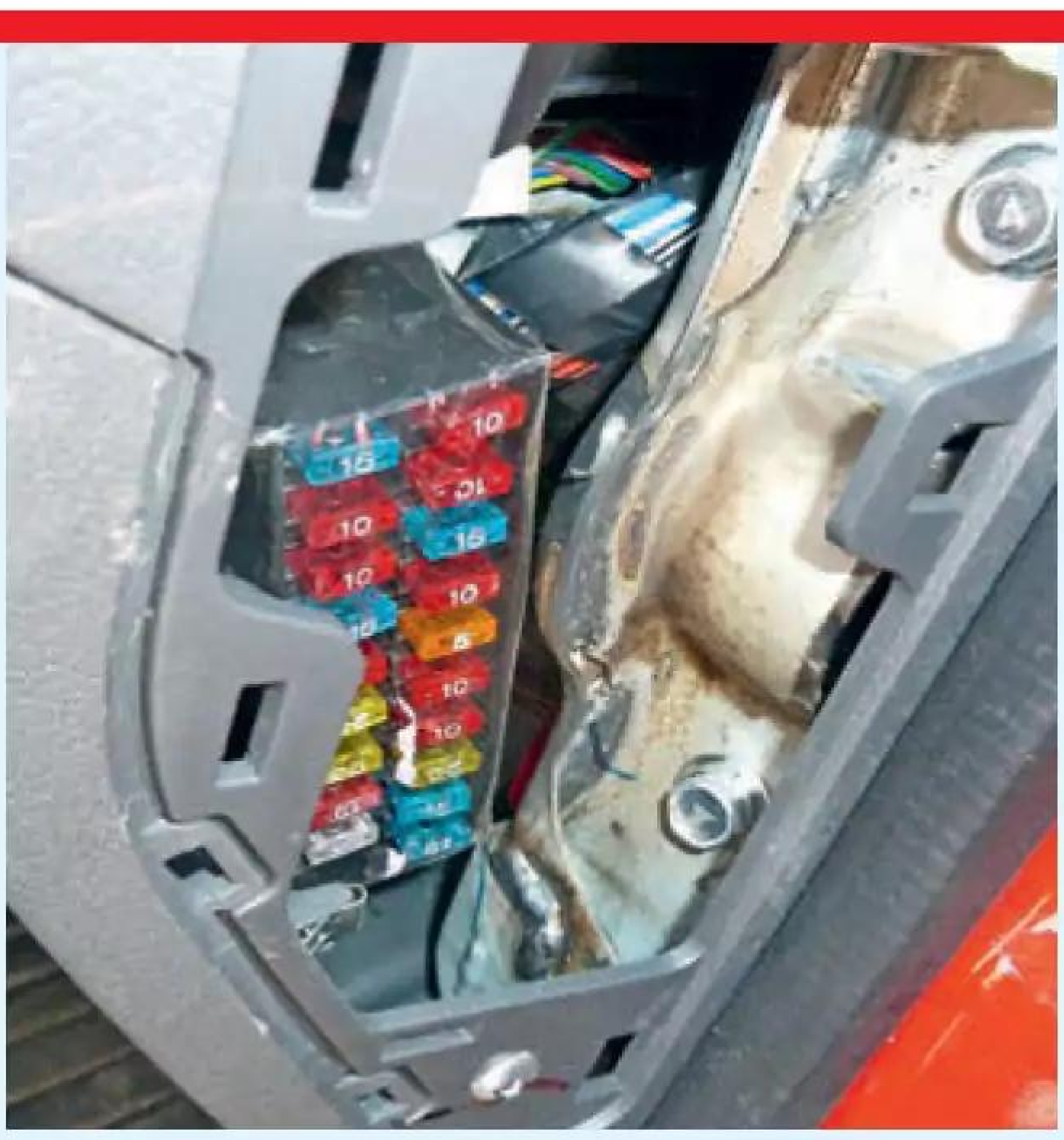
Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is ideal for this Proton and works with a multitude of other makes and models.

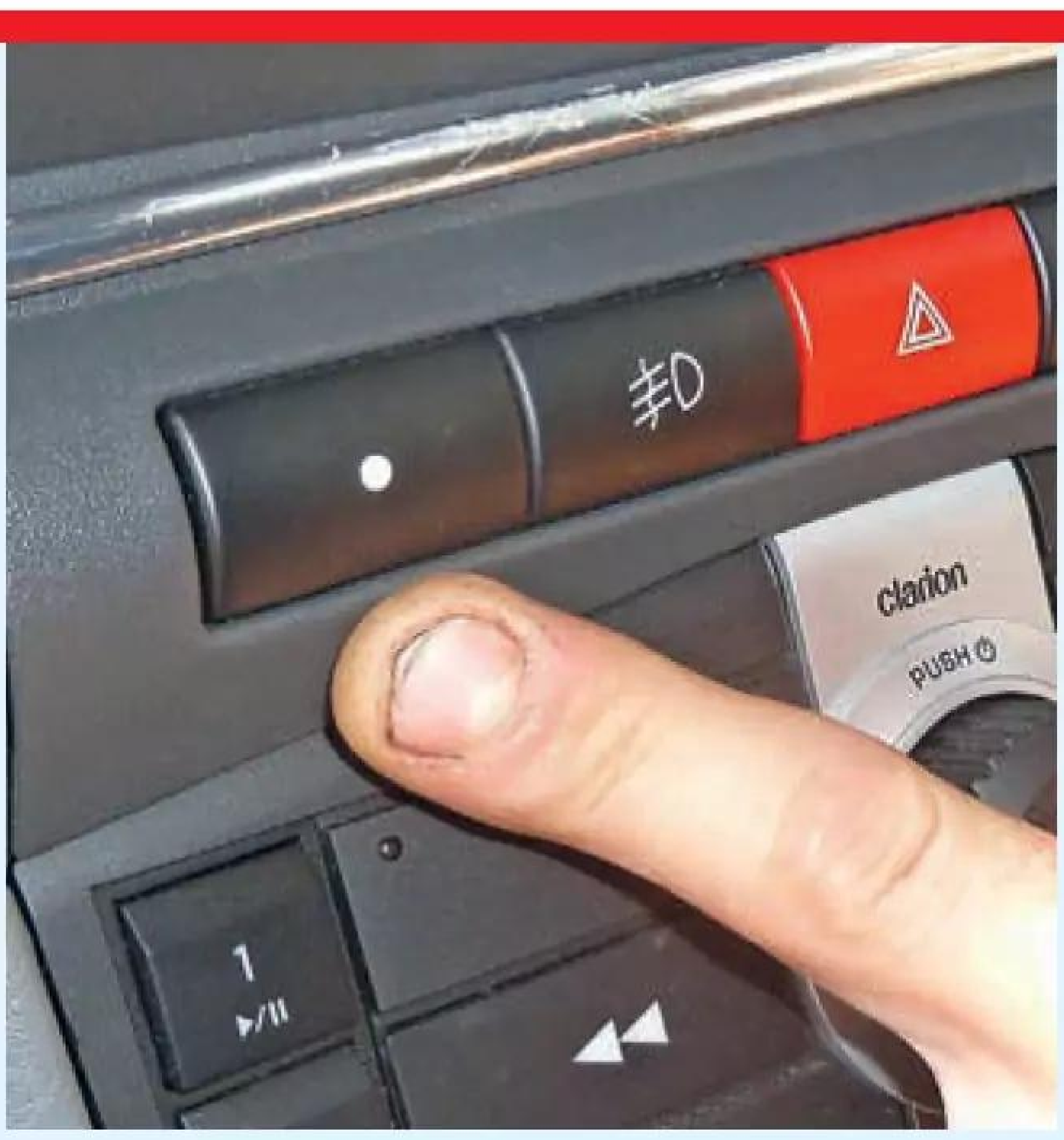
Technical Specs

Actual values

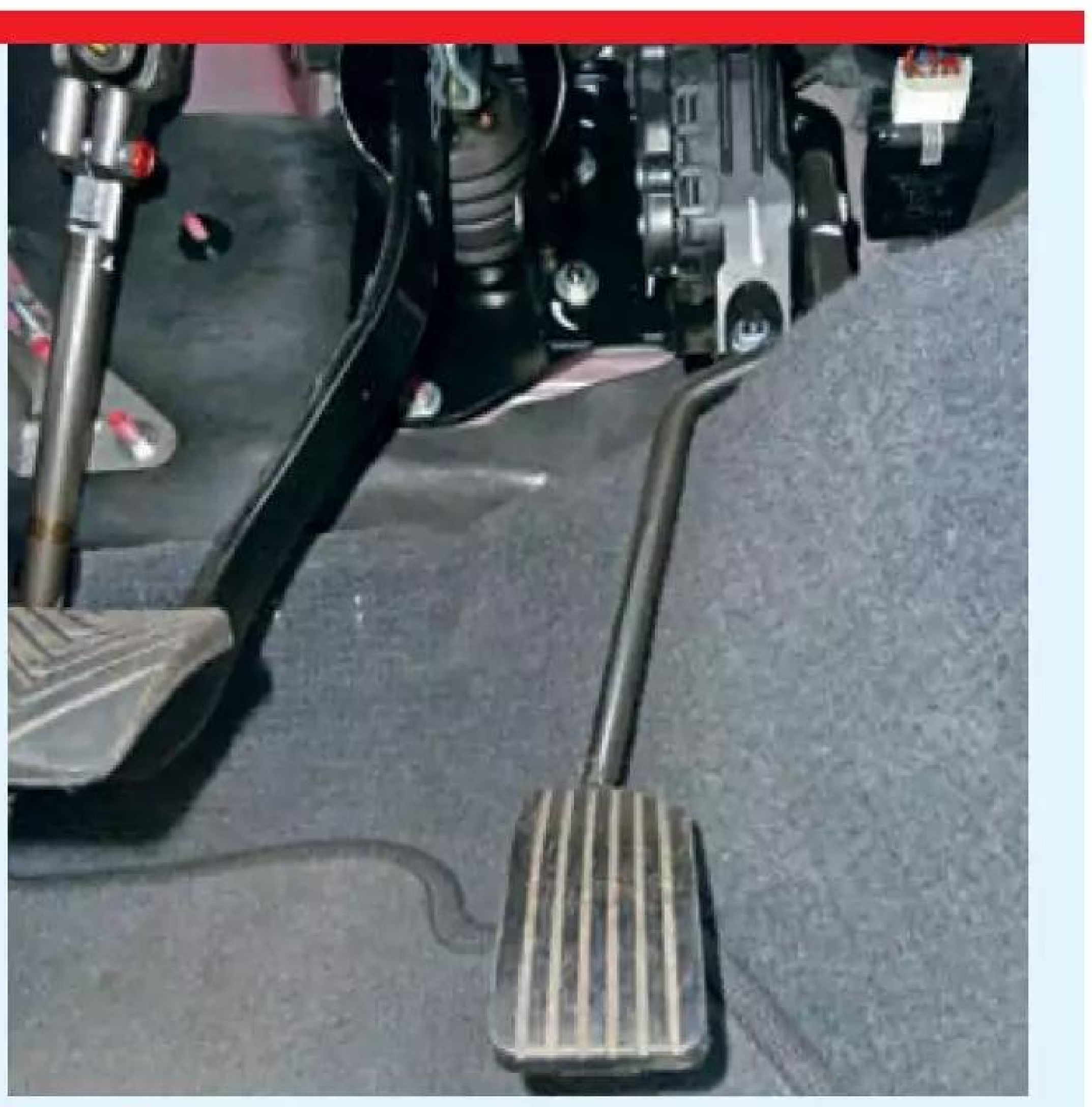
Component	Value
Fuel pressure	3.5 bar
Oxygen sensor heater circuit	3.2-3.5 ohms
Injector resistance	12 ohms
Crankshaft sensor	231 ohms
Coolant temperature sensor:	
Resistance at 20°C	1939 ohms
Resistance at 80°C	272 ohms



12 There's an in-car fusebox, positioned at the right-hand end of the facia, and normally concealed by a plastic cover panel. This is easy to remove and to re-fit, and the fuses are readily accessible.



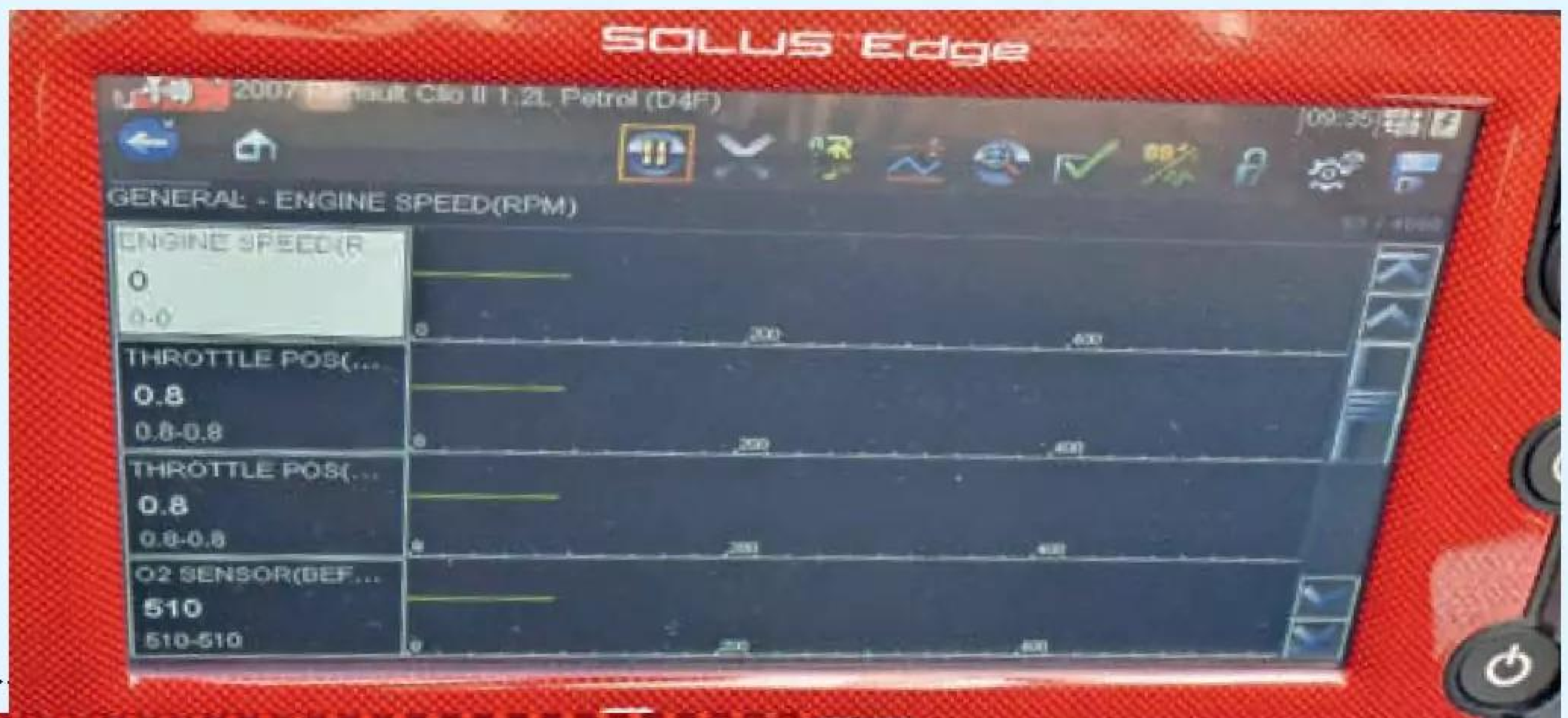
13 There's a useful button on the dash, for use when programming the car's key assemblies. You'll find the full procedure covered within our 'Preparation' section; refer to this for details.



14 The throttle position sensor is mounted at the top of the accelerator pedal. This is a 'drive-by-wire' system; it's imperative that checks are made regarding the components' security and condition, to ensure continuing effective operation.

15 The Savvy's diagnostic socket is located at the lower edge of the facia, on the right-hand side. In this photograph it is seen with the SOLUS Edge diagnostic tool plugged in, ready to interrogate the system.

16 ▶ This shot of the SOLUS Edge monitor shows the display of live data relating to the engine speed. Note that there is no information available regarding this equipment's use on the Proton Savvy, but Edward was able to use the tool on this car by entering the equivalent Renault Clio model.



2007 Renault Clio II 1.2L Petrol (D4F)

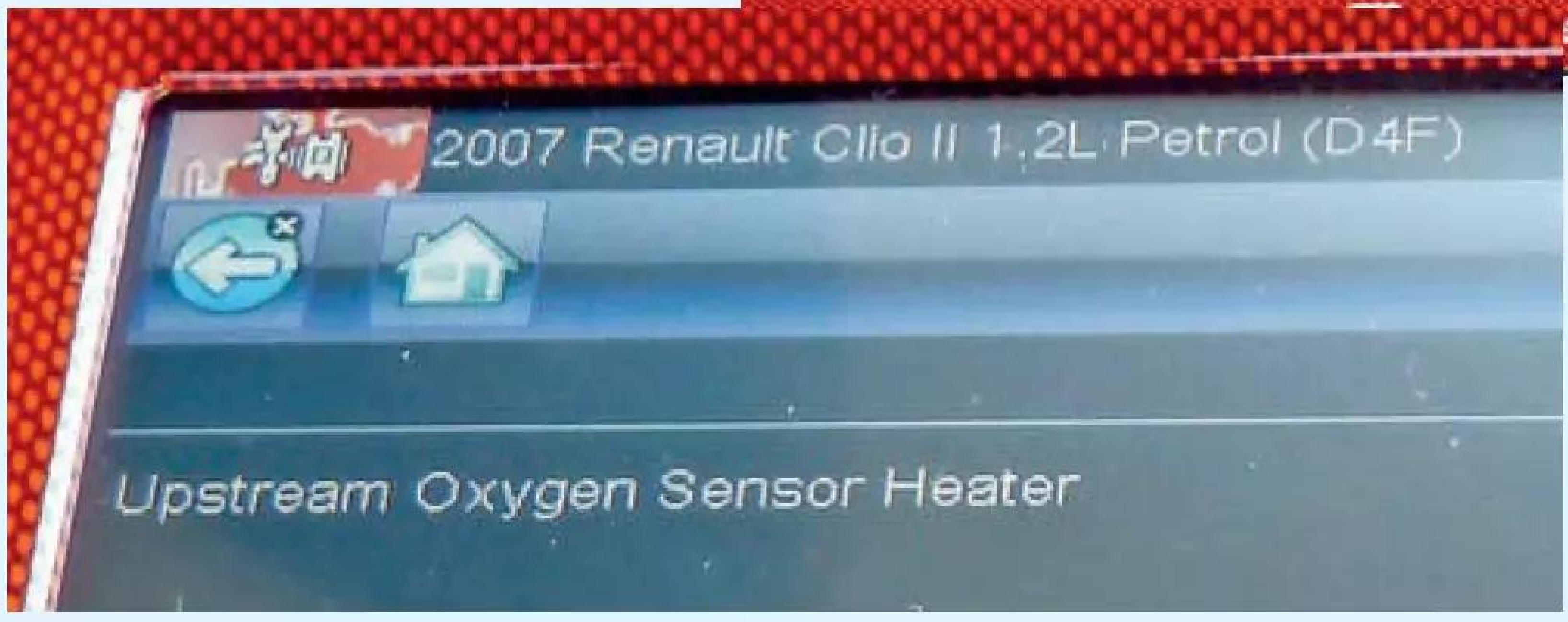
GENERAL - ENGINE SPEED(RPM)

ENGINE SPEED(R
0
0-0

THROTTLE POS(...
0.8
0.8-0.8

THROTTLE POS(...
0.8
0.8-0.8

O2 SENSOR(BEF...
510
510-510



2007 Renault Clio II 1.2L Petrol (D4F)

Upstream Oxygen Sensor Heater

17 ◀ This shot of the SOLUS Edge relates to Edward's test of the Savvy's oxygen/ Lambda sensor heater circuit. Again, this test procedure was accessed by entering the vehicle make and model as a 2007 petrol Renault Clio, as Protons don't feature on the tool.

Electronic Diagnostics

TOYOTA AVENSIS 2.0-LITRE DIESEL

Tracing and fixing faults in electronic engine management systems

Toyota's second-generation diesel-powered Avensis can make a cost-effective used buy. **Kim Henson** and **Edward Haggar** take a look at the electronic diagnostic aspects of this model.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Toyota's Derbyshire-built first-generation (T220) Avensis was introduced in 1997 and ran until 2002, with second-generation (T250) models arriving early in 2003 and produced until 2009 (when the third-generation Avensis was launched).

This feature concentrates on the second-generation Avensis, produced in four-door saloon, five-door hatchback and five-door estate car forms. All Avensis models were praised for their reliability, comfort and practicality.

Engine choices were between 1.6-, 1.8-, 2.0- and 2.4-litre petrol units, or 2.0-litre 'D-4D' and 2.2-litre D-4D diesel units. The D-4D motors employed very high fuel pressures within a common-rail supply system, to optimise performance, emissions and fuel consumption. The fuel is delivered to the engine via solenoid-type Denso injectors.

The second-generation cars were facelifted in 2006, with a raft of upgrades – with the 2.0-litre diesel motors uprated to produce more power.

Our vehicle here is a 2004 Avensis with the 2.0-litre D-4D engine, and our guide to the diagnostic aspects of this Toyota's power unit is Edward Haggar.

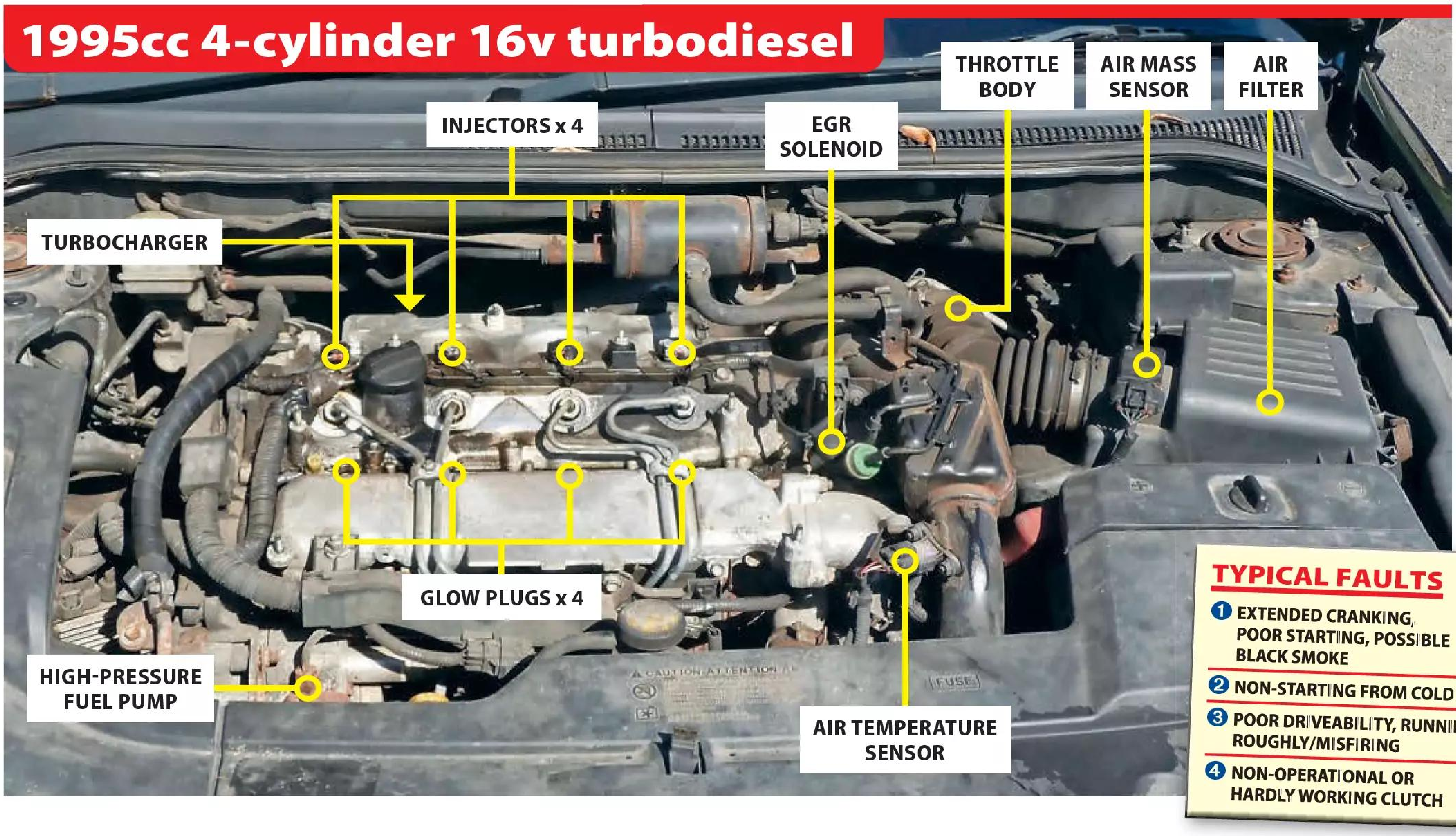
Edward adds that these Toyotas are made of strong stuff and are renowned for their mechanical longevity and reliability, given proper servicing.

He keeps an eye on local taxi fleet cars, which are involved in constant stop-start running that is hard on a vehicle, and says that in the 2000s these Avensis models were the car of choice for taxi drivers.

He goes on to say that it is not unusual to find examples that have clocked up in excess of 200,000 miles – given frequent, correct maintenance – and he knows of one car that has covered 480,000 miles so far, and still running on the original mechanical internal components.

Edward feels that the only minus point is that, compared with, say,

1995cc 4-cylinder 16v turbodiesel



TYPICAL FAULTS

1. EXTENDED CRANKING, POOR STARTING, POSSIBLE BLACK SMOKE
2. NON-STARTING FROM COLD
3. POOR DRIVEABILITY, RUNNING ROUGHLY/MISFIRING
4. NON-OPERATIONAL OR HARDLY WORKING CLUTCH

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is perfect for this Avensis. It is a useful tool for many other makes and models too.

the Peugeot/Citroën HDi turbodiesel engines, the Toyota units are a little more noisy in operation.

Preparation

At the outset you will need to remove the plastic cover from the top of the engine; this panel is secured by five bolts (10mm socket spanner); removal and re-fitting is rapid and straightforward.

There's quite a bit of underbonnet space in which to work, and in many respects the car is easy to service at home. Having said that, some components, including the turbocharger and the fuel pump, are tucked away and access is not great. The same applies to the fuel filter but it is worth renewing it anyway at least once a year or ideally sooner. It is surprising what a difference a new filter can make to the car's running.

Always fill the fuel filter with diesel or fuel system cleaner on re-assembly, to aid priming. Edward does not recommend cranking and cranking an engine to bleed out air.

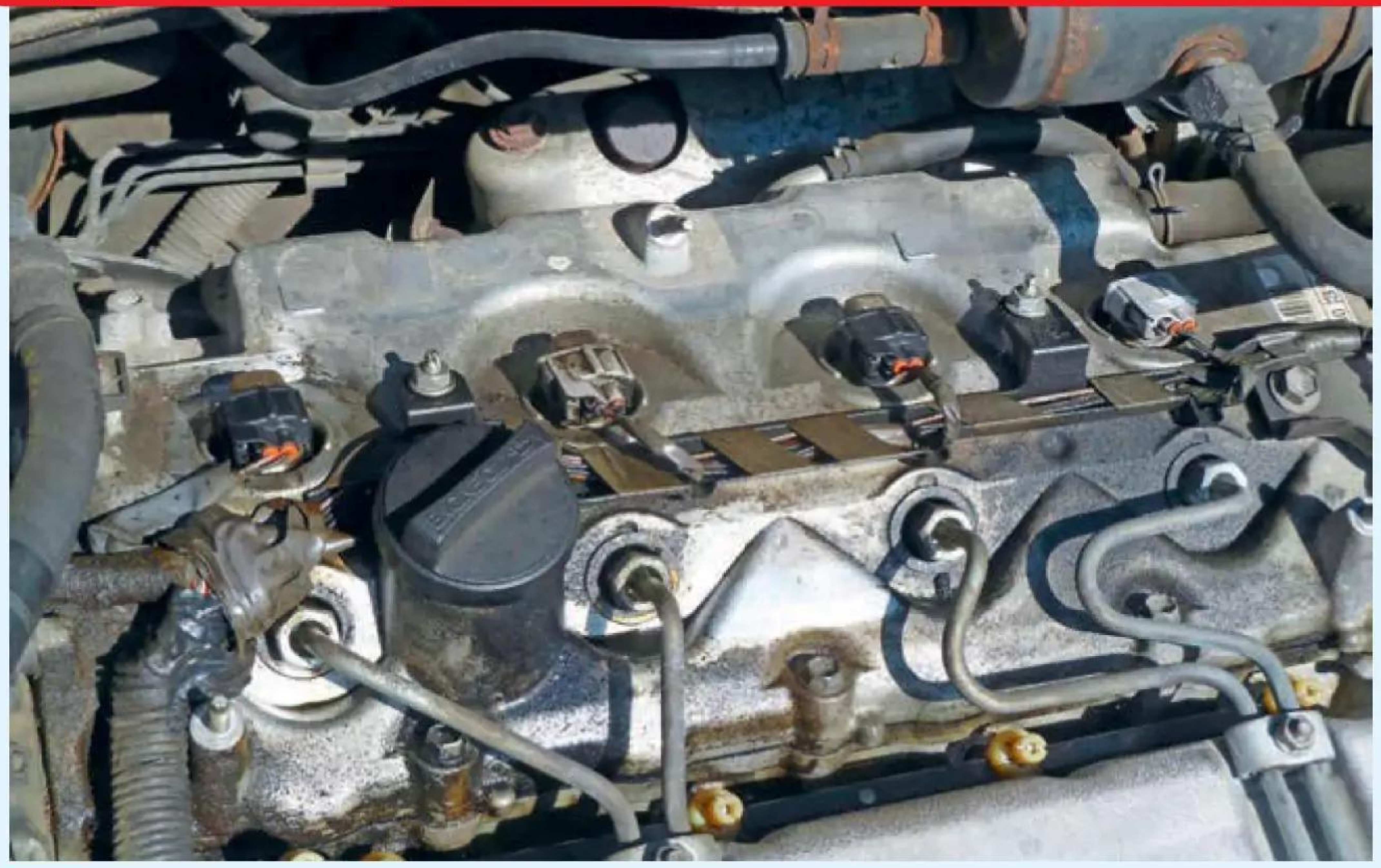
Good news from an ownership point of view is that the 12V battery is a traditional lead-acid type, which is relatively inexpensive to buy and the battery itself can be renewed quite quickly and without difficulty – also no coding to the vehicle is required. When installing the battery, apply a little anti-seize compound to the securing fastener threads, and protective waterproof silicone grease to the battery connections/terminals, to protect against moisture ingress.

Our usual advice applies: carry out a full service if the maintenance history of the car is not known. In addition, during maintenance and repair work always use components to original equipment quality. These steps will help to preserve the engine and maintain efficient, trouble-free running.

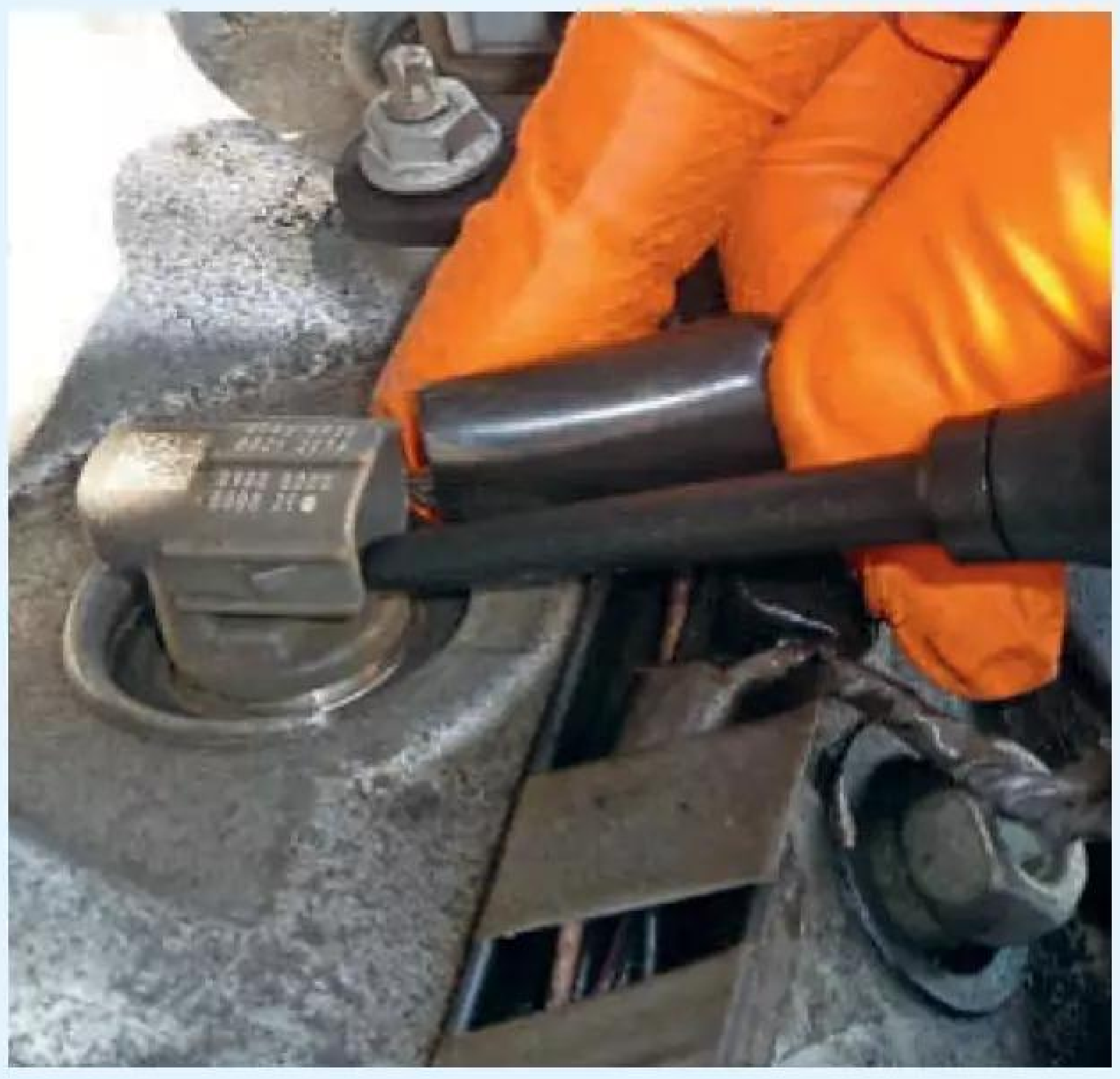
Always check water pump condition when renewing the cambelt; renew the pump if there are signs of bearing play or leaks (not the easiest of jobs for a home mechanic, but it can be achieved with patience and a comprehensive toolkit).

While a diagnostic tool is required for some of the more complex interrogation operations on the management system, equally a good quality multimeter can help with many of the basic assessments.

Typical Toyota Avensis components

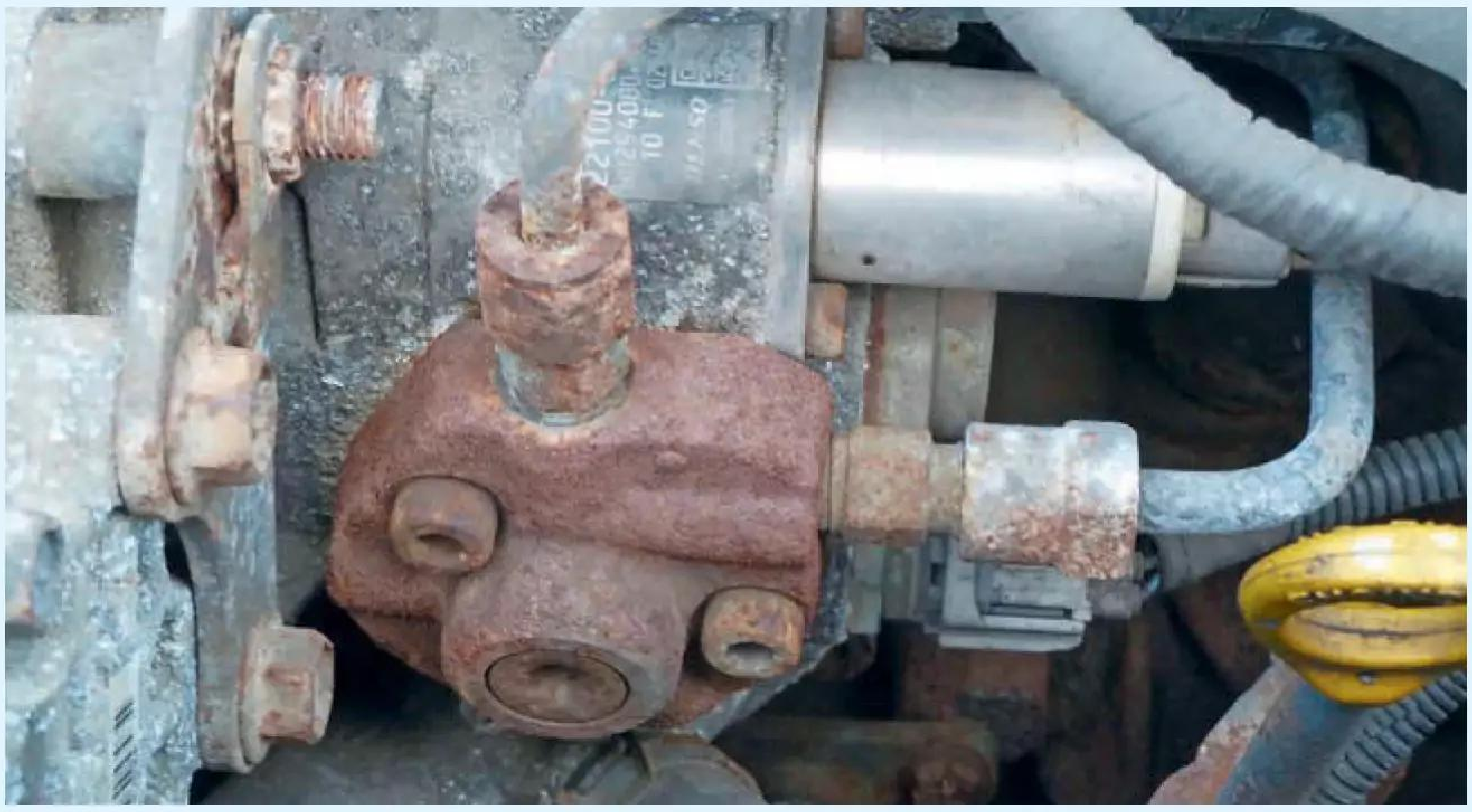


1 With the engine cover removed, the upper part of the motor becomes accessible, including the fuel injectors, at the top of the unit. The injectors are individually coded (marked on the injectors) and it's essential that their codes are correctly input to the ECU.



2 With its wiring connector plug detached, fuel injector resistance can be assessed using a quality multimeter. The code for the injector – visible in this photograph – can be seen, marked in white on the top of the component's body.

3 Your trusty multimeter can also be used for checking the electrical resistance of the glow plugs. As with the fuel injectors, the four glow plugs are readily accessible close to the top of the power unit.



4 Towards the right-hand side of the engine compartment you will find the high-pressure fuel pump. The pump body and its pipework are vulnerable to corrosion; check this aspect and ensure that there are no fuel leaks.

⇨

ENGINE MANAGEMENT

The management system used on this Avensis incorporates these primary components:

- Multiplug ECU.
- 4 x solenoid type Denso fuel injectors.
- Air mass sensor, built into air filter trunking.
- ABS pump/ECU.
- Vacuum controlled EGR valve.
- 4 x glow plugs.
- Cambelt driven high-pressure fuel pump.
- Low pressure pump, built into high pressure pump.
- Coolant temperature sensor (monitoring coolant temperature).
- Standard lead-acid cell type battery.
- Accelerator pedal position sensor.
- Vacuum operated turbo wastegate.

Fault 1:

INJECTOR FAULTS

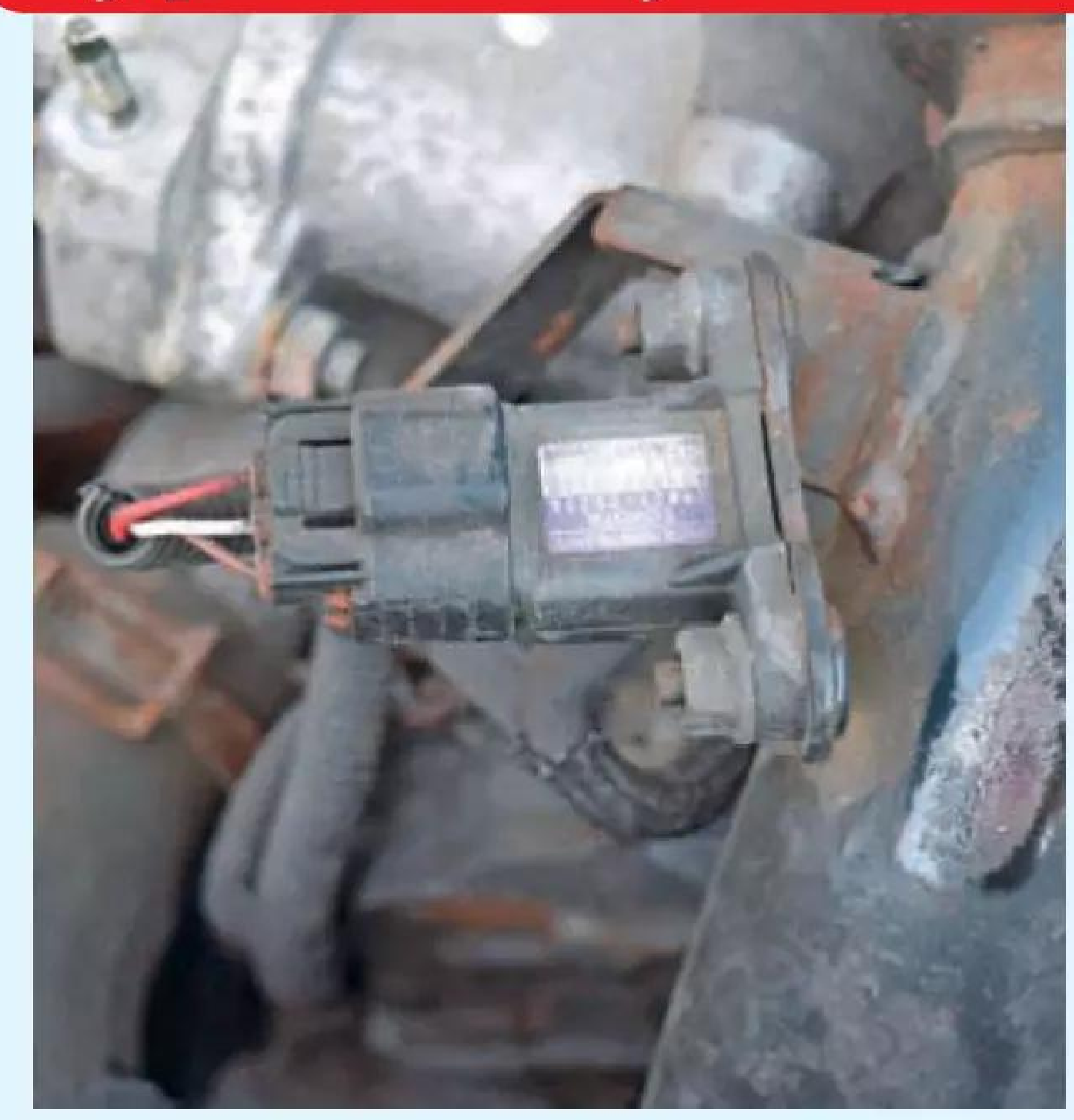
Our first fault will result in poor starting with extended cranking, and possibly with black smoke from the engine (exhaust) when running. Under acceleration it might feel as if the engine is suffering from a misfire, but the fault lies with an injector.

Possibly you will also see the engine warning light illuminated, and with a fault code stored, relating to the offending cylinder.

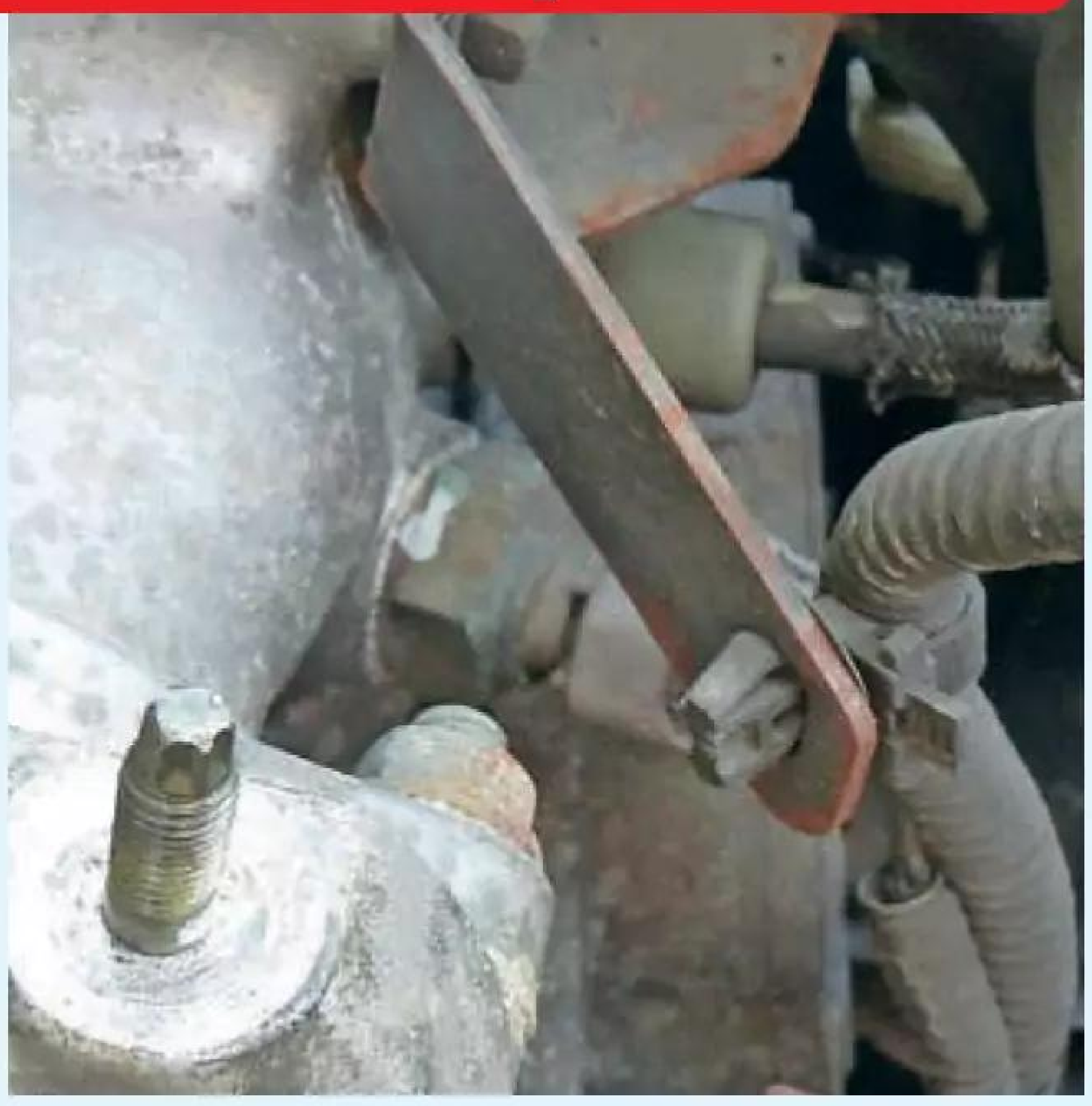
If there's no code stored, and your diagnostic machine allows it, check cylinder balance in live data. This shows all four injectors and the amount of fuelling attributable to each one; you should see the failing cylinder behind the others. A 'leak off' test is another useful check.

Edward says that he finds that generally the injectors fail in the windings, so a resistance check will show the culprit failing. Remember to code the new part in – it's also critical to replace all the seals when installing the injectors, to ensure a nice, positive air tight seal.

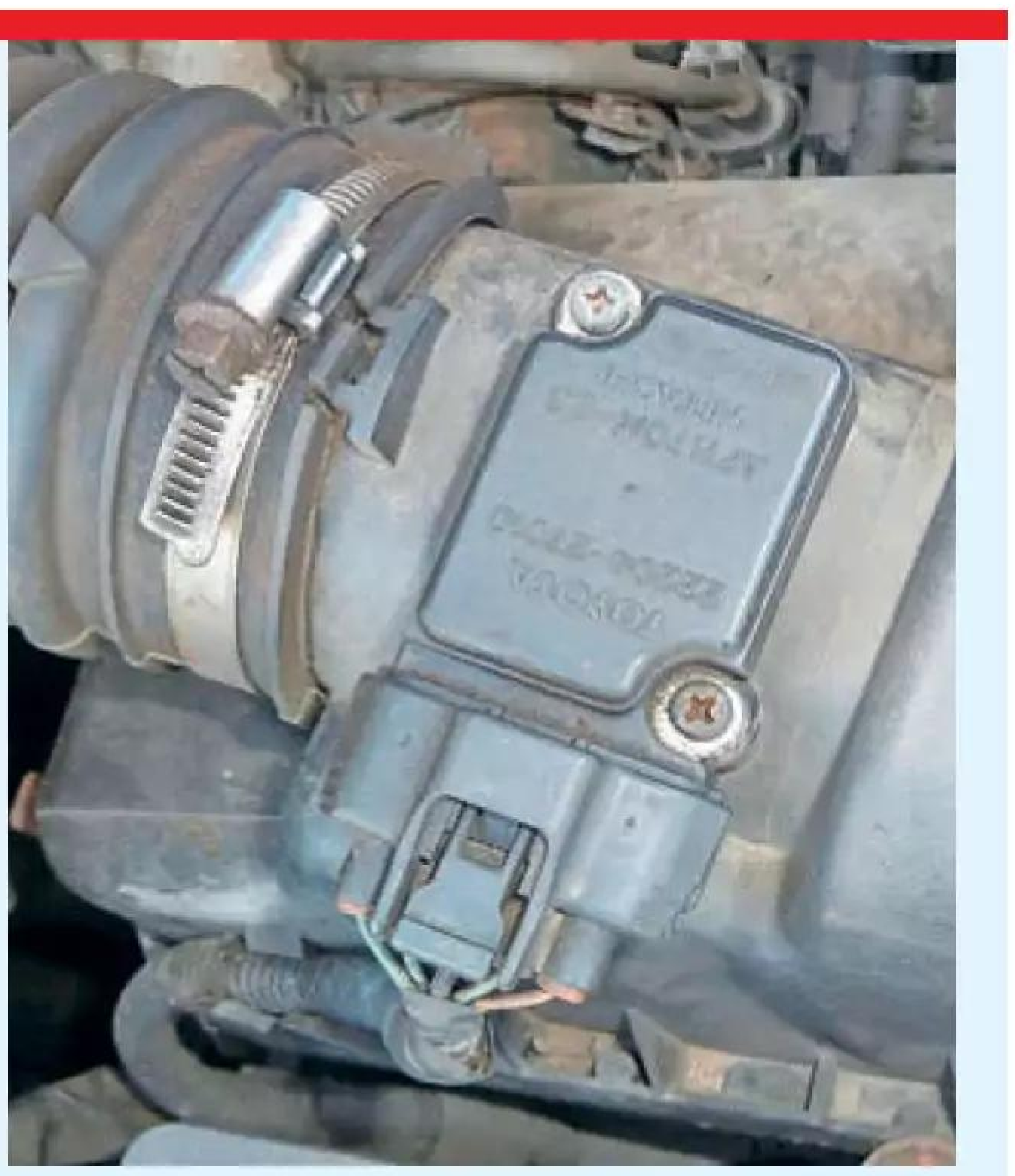
Typical Toyota Avensis components



5 The Mass Absolute Pressure (MAP) sensor is located at the inlet/intake manifold. Its job is to monitor the pressure at all times within the manifold, relaying this information to the ECU, which accordingly determines the required fuelling levels.



6 Not very easy to see, nor to photograph, is the air temperature sensor. In this photograph it is the hexagonal component seen approximately in the centre of the shot, beneath the steel bracket supporting the nearby section of the wiring loom.

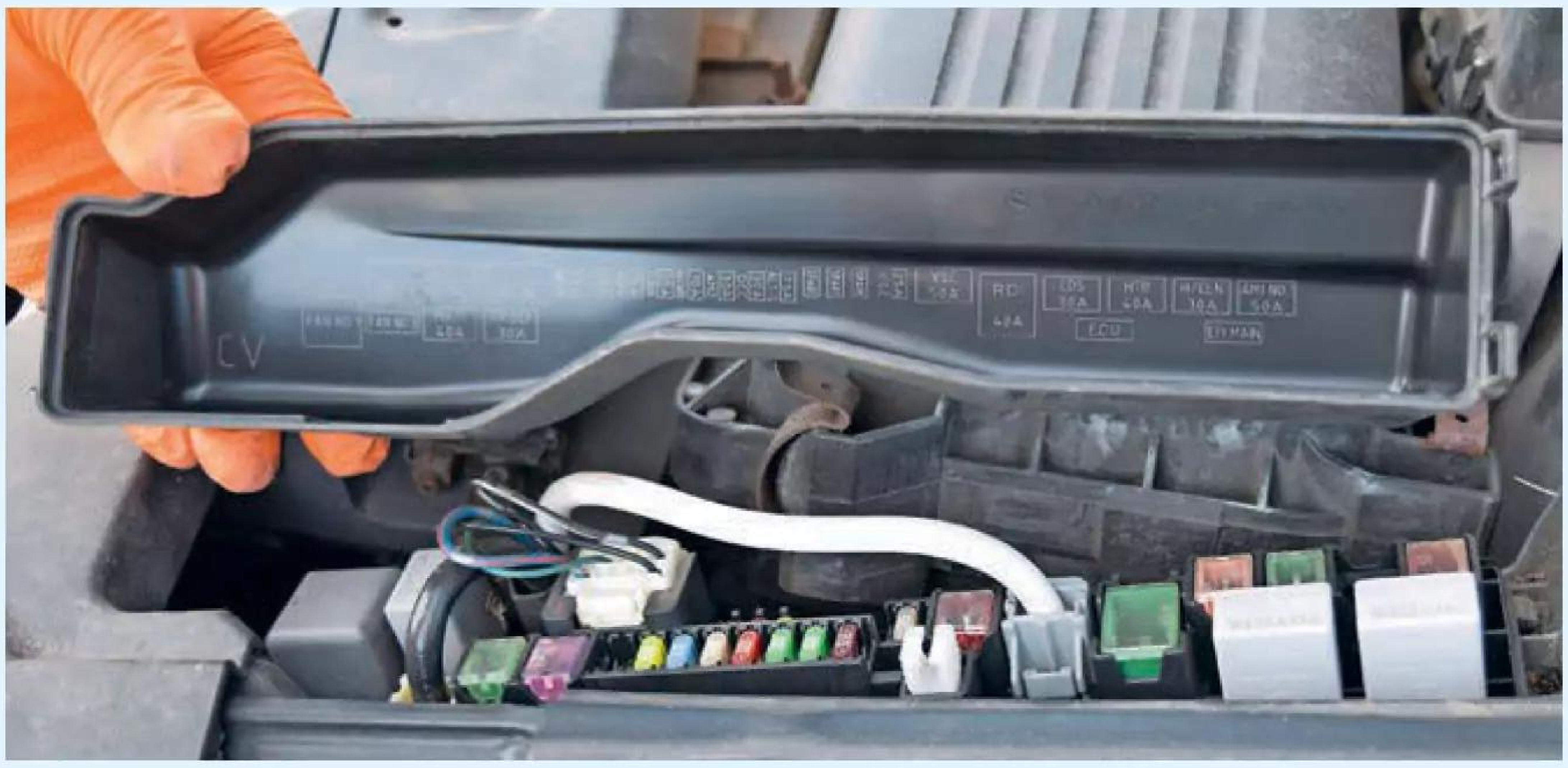


7 The Mass Air Flow (MAF) meter/ sensor is positioned within the inlet/ intake trunking, and is secured in place by two screws. Its function within the system is to monitor air flow rates and to feed this info to the ECU, to adjust fuelling levels.

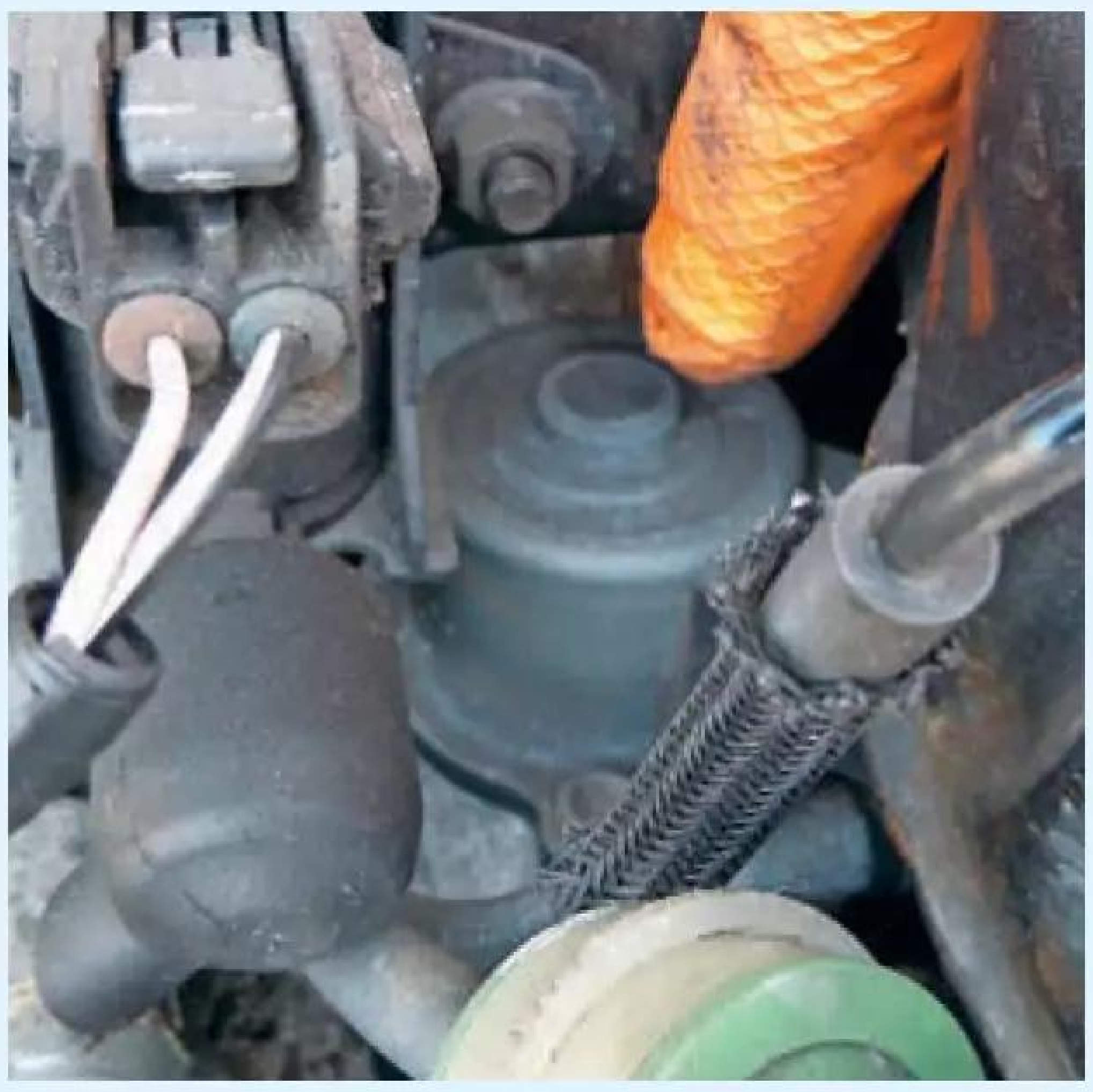
8 Should you ever need to reach it, it may help you to know that the starter solenoid is hidden away at the front of the engine compartment, and can be seen here in the centre of the photograph.

9 The 12V battery is partially obscured from above, but not too difficult to reach and deal with. Renewal is helped by the fact that it is a traditional lead-acid type. When renewing, no coding is required for the ECU to work correctly with the new unit.

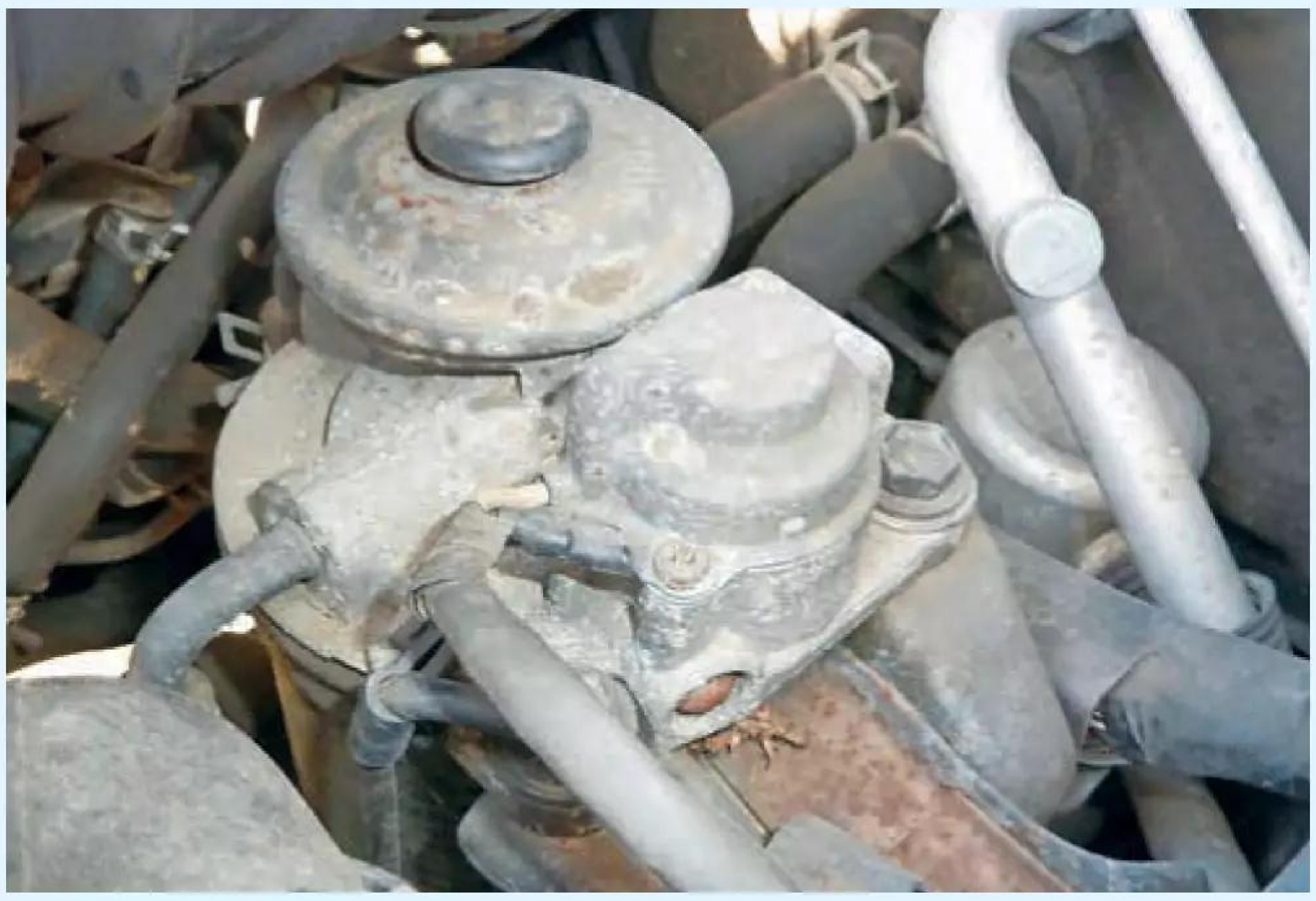
10 Close to the fuel filter, on the left-hand side of the engine compartment, is the glow plug relay. This relay controls the glow plug system, using data from the temperature sensor on the cylinderhead. (See *Fault 2*).



11 The underbonnet fusebox is located on the left-hand side of the engine compartment, and inscriptions on the underside of the fusebox lid show the locations and amperage ratings of the fuses within.



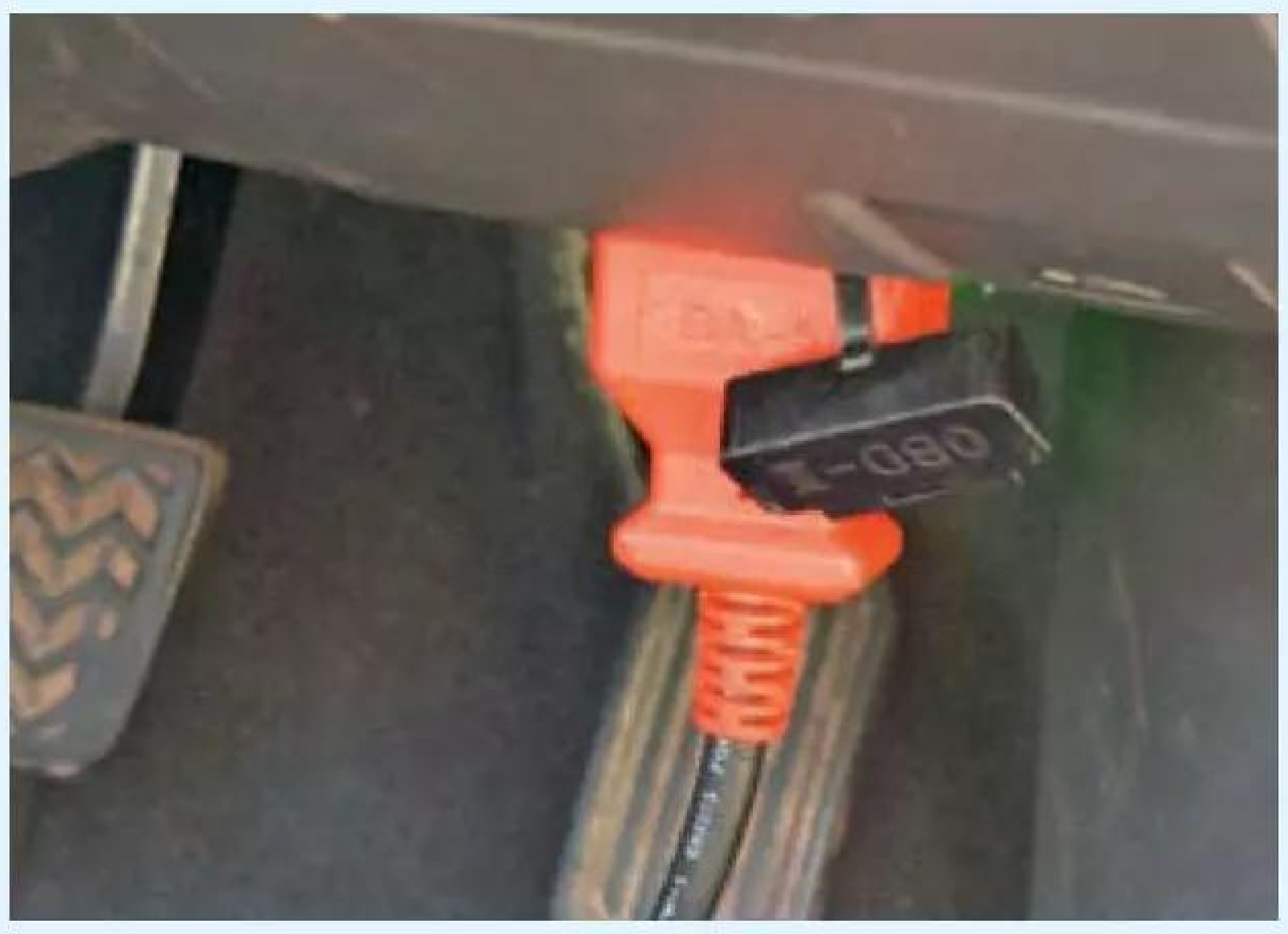
12 Way down low within the engine compartment, and close to the left-hand end of the cylinder-head, is the Exhaust Gas Recirculation (EGR) valve assembly.



13 ◀ Mounted low down on the left-hand side of the engine bay is the high-pressure diesel fuel pump. Helpfully, Toyota has built-in a manual primer button on top of the pump, to help draw through fuel if ever the system had been disturbed/drained and re-filled.

14 The turbocharger can be seen here in the background. For long turbo life it's essential that the engine oil is clean at all times. Check all pipework connected to the turbocharger; difficulties will arise if air leaks are present.

15 ▶ At the right-hand end of the engine, and hidden beneath the cover shown here, is the cambelt. It's imperative that the belt is renewed at least as often as recommended by Toyota. Always check water pump condition when renewing the cambelt (see *Preparation* section).



16 The diagnostic socket is located on the right-hand side of the facia, and when not in use is protected by a black clip-on plastic cover, embossed with the lettering 'OBD-II'.

Fault 2:

DEFECTIVE GLOW PLUG

When our second fault occurs, again the engine may refuse to start, although it's likely that once the vehicle has been driven and with the motor hot it will start okay. However, in the mornings, in cold-start situations, it won't play ball.

The fault lies with a defective glow plug (or more than one). Testing is by means of a simple resistance check, but replacement can be tricky if the unit has seized in the cylinderhead. Apply a good covering of penetrating fluid before attempting to unscrew the old glow plug, and consider, if finances allow, changing all four at once because if one is defective the others probably aren't too far behind it.

A word of warning, cheap glow plugs are a very definite 'no no'. Edward quotes the occasion when he was called by a customer complaining of a non-start – but the customer had himself replaced his Toyota's glow plugs... It turned out the original plugs had been replaced with some awful non-original copies of nondescript origin – but they were cheap! – and they weren't getting hot enough to heat the cylinder; a false economy.

It is worth saying also that if the glow plugs are not receiving an electrical signal the problem may be due to an ailing glow plug relay – check for water ingress, which can occur as the unit is located in a vulnerable position.

Fault 3:

EGR VALVE STICKING

If the car is suffering from poor driveability, with misfiring and rough running, the fault is with the EGR valve sticking either hot or cold, open and or shut. If carrying a diagnostic check you will see stored fault codes relating to EGR and air flow. The good news is that the EGR valve unit is very strong and durable, so removing and cleaning it will likely cure the trouble; a decent quality purpose-developed cleaning agent should be used. Before re-fitting the EGR valve, check the condition of the gasket and replace as necessary.

EGR blanking is a option on these engines but Edward says that he is not a massive fan of removing something that should be there.

Fault 4:

CLUTCH MASTER CYLINDER PROBLEM

When this fault raises its ugly head, the clutch pedal will not be operating as it should. Most commonly it will stick slightly down, or you may have to pump the pedal in order to be able to disengage/engage the gears.

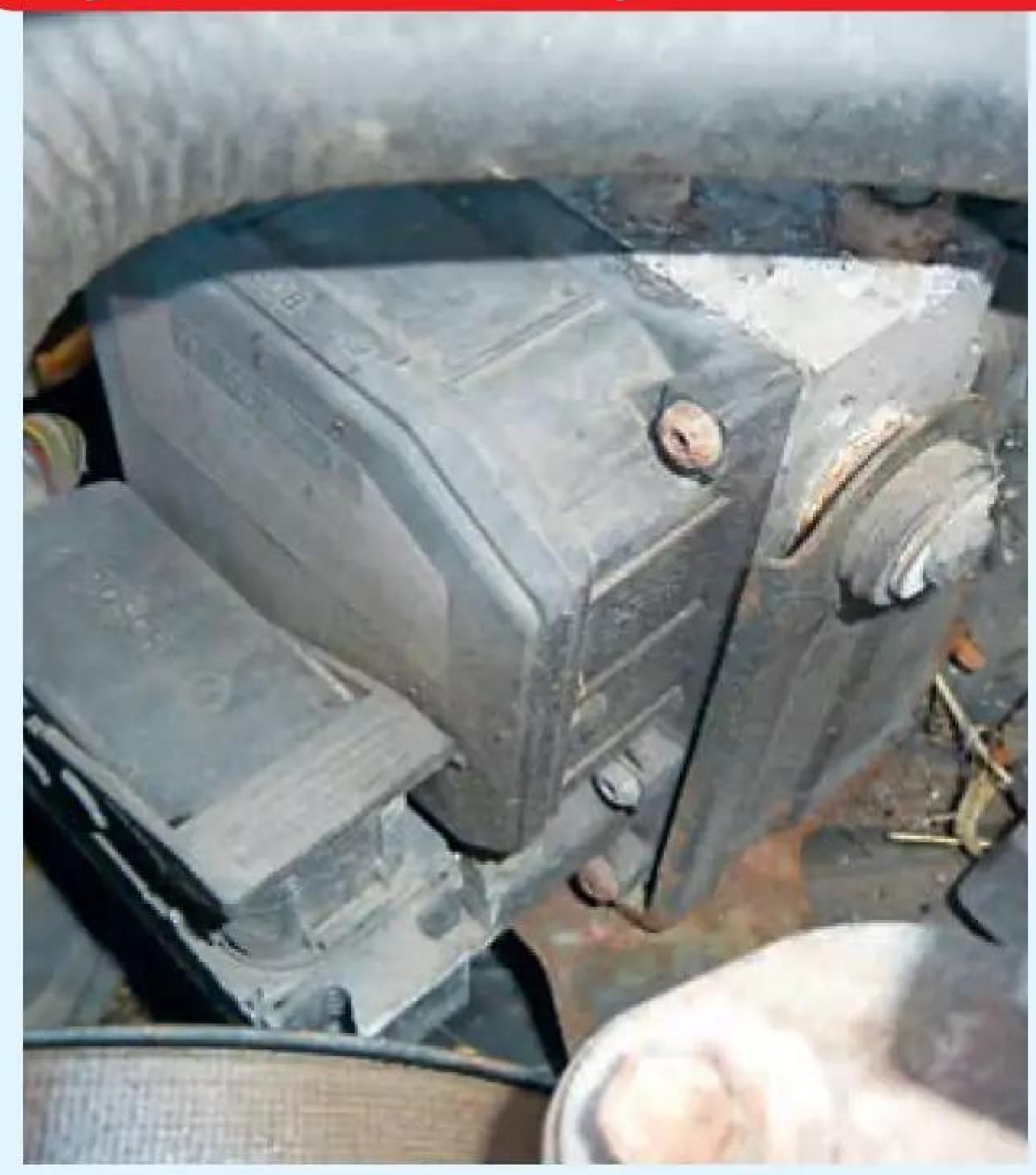
The fault is with the clutch master cylinder. However, first check the pipework because on some of the older models this can rust and cause air ingress, giving symptoms of cylinder failure.

Technical Specs

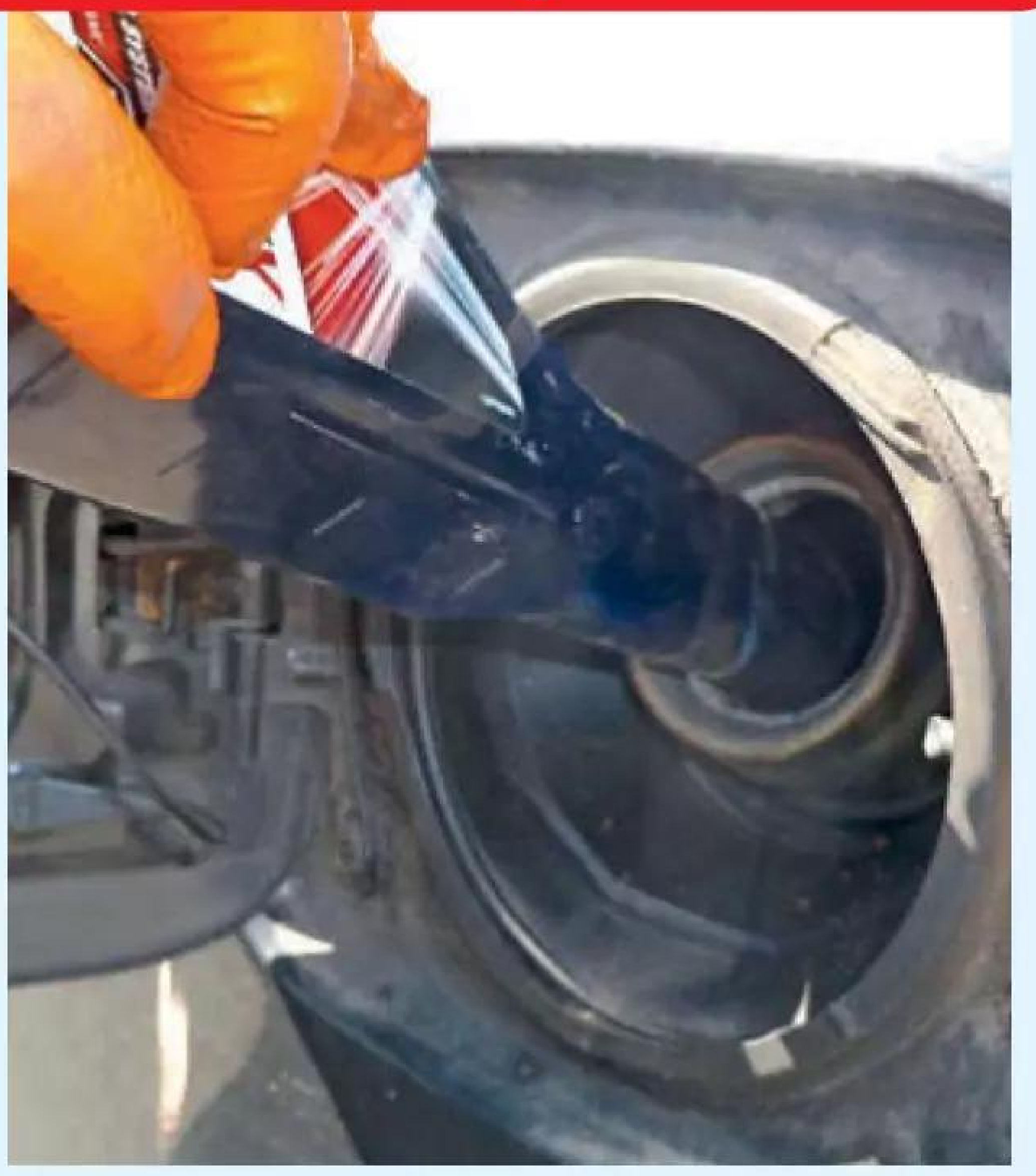
Actual values

Component	Value
Fuel injector resistance	0.8-1.0 ohms
Injection sequence	1-3-4-2
Glow plug resistance	0.2 ohms
Fuel control	2.7 ohms
Crank sensor	2144 ohms
Crankshaft position sensor/engine speed (RPM) sensor	1630-2740 ohms
Cam sensor	2113 ohms
Engine coolant temperature (ECT) sensor	310-326 ohms at 80°C
Intake air temperature (IAT) sensor	2210-2650 ohms at 20°C
Valve clearances: Inlet Exhaust	 0.20mm 0.35mm

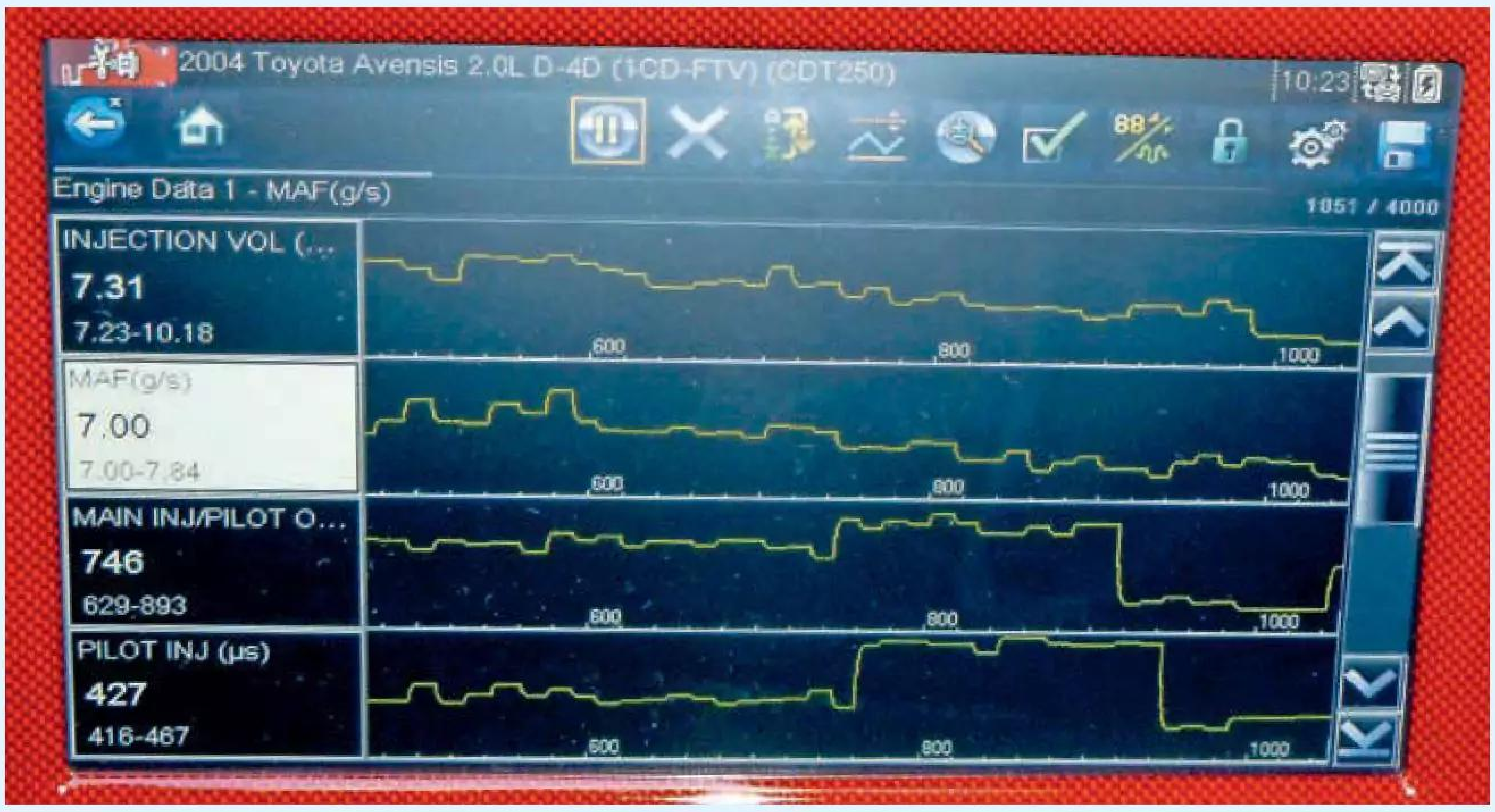
Typical Toyota Avensis components



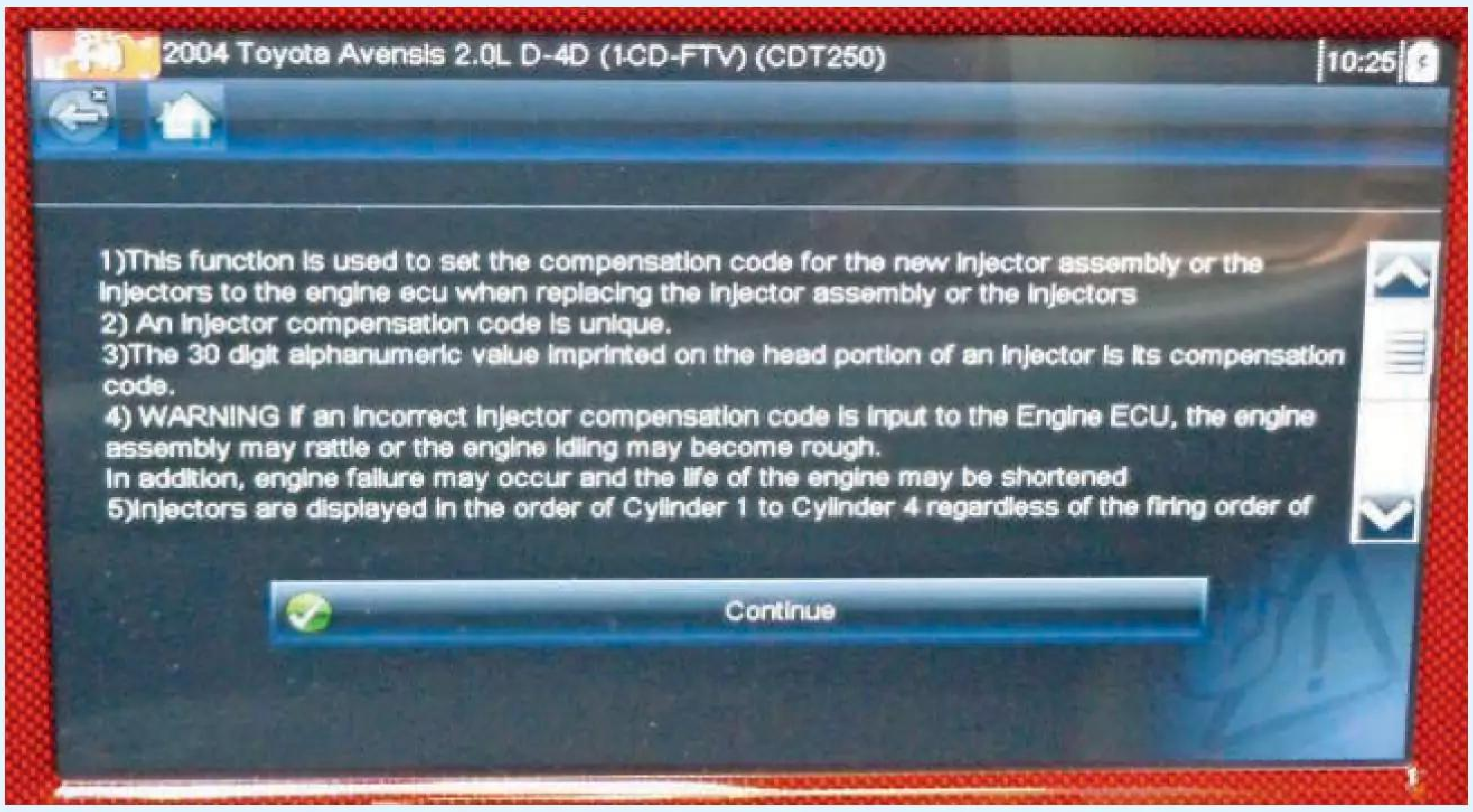
17 Shown here is the ABS (anti-lock brake system) pump assembly, which incorporates its own ECU. Check for structural integrity of the unit, and for cleanliness and security of all the electrical wiring and connections.



18 Edward advocates the regular use of a proprietary fuel system additive/cleaning agent, to help ensure that the injection system is internally clean and protected, and thus able to operate at optimum efficiency in the long run.



19 This screenshot of the Snap-on SOLUS Edge diagnostic tool is showing live data relating to the Toyota's Mass Air Flow/fuel system operation. It can be invaluable for an operator to be able to see exactly what's going on in these respects, in 'real time'

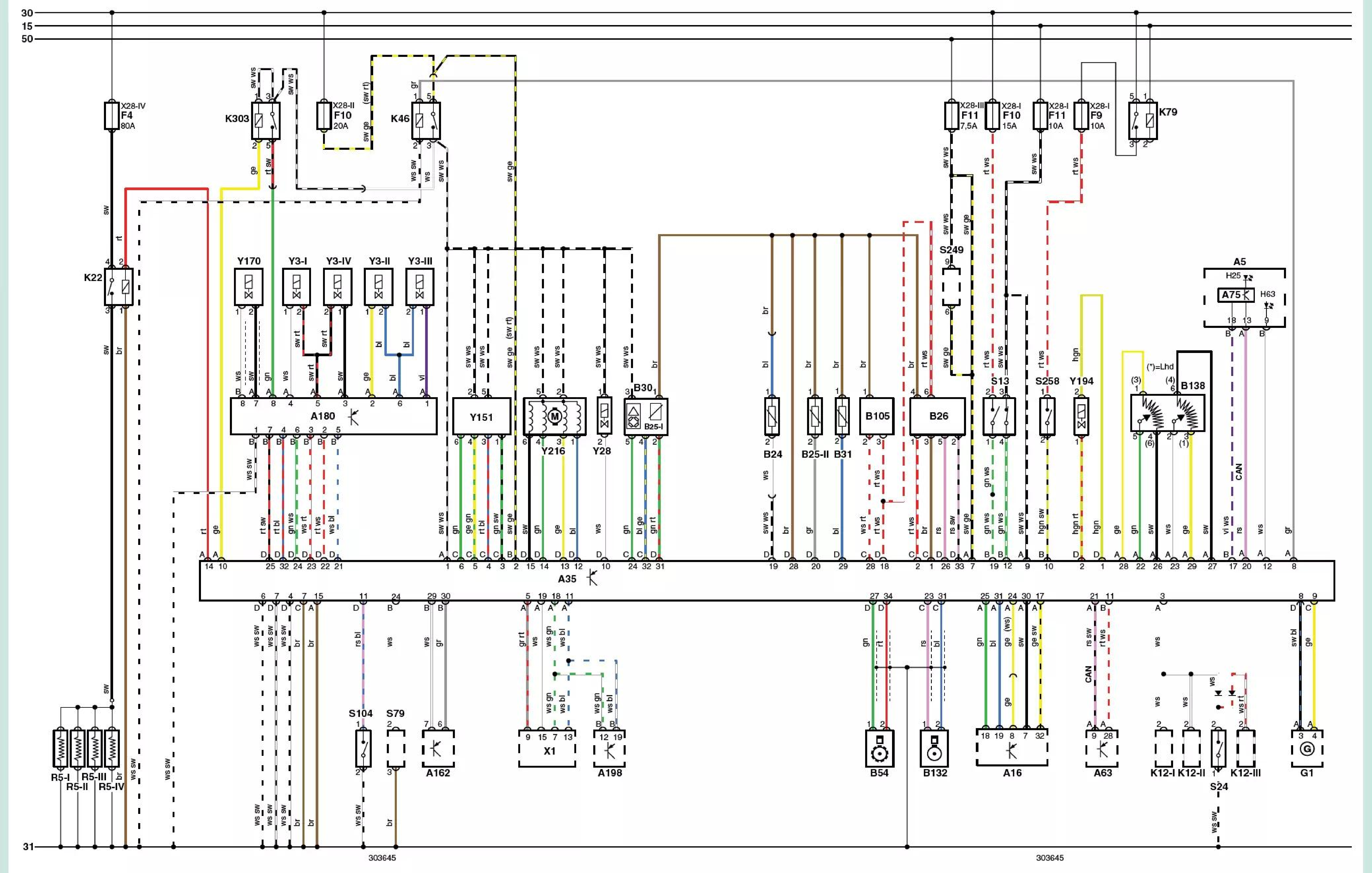


1)This function is used to set the compensation code for the new injector assembly or the injectors to the engine ecu when replacing the injector assembly or the injectors
2) An injector compensation code is unique.
3)The 30 digit alphanumeric value imprinted on the head portion of an injector is its compensation code.
4) WARNING If an incorrect injector compensation code is input to the Engine ECU, the engine assembly may rattle or the engine idling may become rough.
In addition, engine failure may occur and the life of the engine may be shortened
5)Injectors are displayed in the order of Cylinder 1 to Cylinder 4 regardless of the firing order of

20 This screenshot explains the importance of ensuring that the fuel injectors are correctly coded/introduced to the ECU. The on-screen message warns of possible rattling/rough running/engine damage if the injectors are not correctly coded…

TOYOTA AVENSIS CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
50
X28-IV F4 80A
K303
X28-II F10 20A
K46
X28-III F11 7,5A
X28-I F10 15A
X28-I F11 10A
X28-I F9 10A
K79
K22
Y170
Y3-I
Y3-IV
Y3-II
Y3-III
A180
Y151
Y216
Y28
B30
B25-I
B24
B25-II
B31
B105
B26
S249
S13
S258
Y194
(*)=Lhd
B138
A5
H25
A75
H63
CAN
A35
R5-I
R5-II
R5-III
R5-IV
S104
S79
A162
X1
A198
B54
B132
A16
A63
K12-I
K12-II
S24
K12-III
G1
31
303645
303645

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A16	ABS CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A63	AC CONTROL MODULE
A75	INSTRUMENTATION CONTROL MODULE
A162	IMMOBILIZER CONTROL MODULE
A180	INJECTOR CONTROL MODULE
A198	SUPPLEMENTARY RESTRAINT SYSTEM (SRS) CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25-I	INTAKE AIR TEMPERATURE (IAT) SENSOR | **1**
B25-II	INTAKE AIR TEMPERATURE (IAT) SENSOR | **2**
B26	FUEL SYSTEM PRESSURE SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
G1	ALTERNATOR
H25	GLOW PLUG WARNING LAMP
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K12-I	ENGINE COOLANT BLOWER MOTOR RELAY | **1**
K12-II	ENGINE COOLANT BLOWER MOTOR RELAY | **2**
K12-III	ENGINE COOLANT BLOWER MOTOR RELAY | **3**
K22	GLOW PLUG RELAY
K46	ENGINE CONTROL (EC) RELAY
K79	IGNITION MAIN CIRCUITS RELAY
K303	INJECTOR CONTROL MODULE RELAY
R5-I	GLOW PLUG | **1**
R5-II	GLOW PLUG | **2**
R5-III	GLOW PLUG | **3**
R5-IV	GLOW PLUG | **4**
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S24	ENGINE COOLANT BLOWER MOTOR TEMPERATURE SWITCH
S79	CRUISE CONTROL MASTER SWITCH
S104	THROTTLE POSITION (TP) SWITCH
S249	TRANSMISSION RANGE (TR) SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
X1	DATA LINK CONNECTOR (DLC)
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y3-IV	INJECTOR | **4**
Y28	EXHAUST GAS RECIRCULATION (EGR) SOLENOID
Y151	EXHAUST GAS RECIRCULATION (EGR) VALVE ACTUATOR
Y170	FUEL RAIL PRESSURE (FRP) CONTROL VALVE
Y194	FUEL FLOW CONTROL VALVE
Y216	THROTTLE CONTROL SOLENOID
30	BATTERY +
31	BATTERY -

USEFUL DATA

Below are shown the official recommended change intervals for the various components. We advise that these service/change intervals are at least halved.

ENGINE OIL The official recommendation is to change the oil and filter every 10,000 miles or 12 months, whichever comes first.

OIL TYPE SAE 5W-30 API CF/ACEA B1/C3 fully-synthetic. Use only the recommended specification oil.

CAPACITY (service fill) 5.9 litres.

SUMP PLUG TORQUE SETTING 34Nm.

BRAKE FLUID Every 24 months.

CAMBELT Renew at least every 60,000 miles or 72 months.

FUEL FILTER Officially renew every 40,000 miles or 48 months.

AIR FILTER Officially renew every 40,000 miles or 48 months.

VALVE CLEARANCES Check/adjust every 30,000 miles or 48 months. It is worth renewing the cam cover gasket at the same time, to avoid oil leaks.

Electronic Diagnostics

FIAT DUCATO 2.3 MULTIJET

Tracing and fixing faults in electronic engine management systems

The Fiat Ducato is a popular commercial vehicle and provides the basis for the majority of motorhomes sold in Europe. **Kim Henson** and **Edward Haggar** investigate the electronic diagnostic aspects, using a 2008 motorhome as an example.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

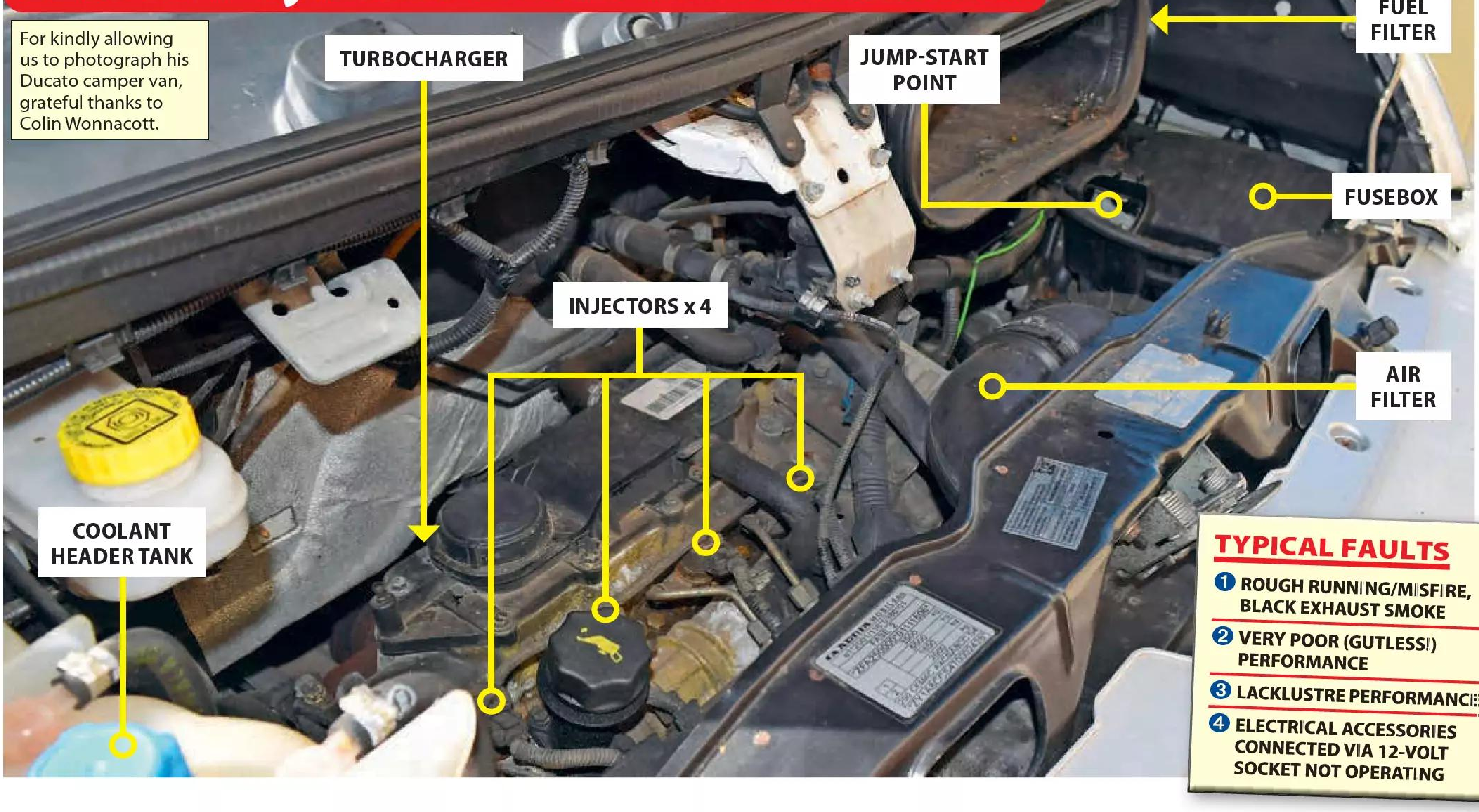
The original Fiat Ducatos, produced from 1981, were the result of a joint manufacturing project between Fiat and the PSA Group (Citroën and Peugeot), with badge-engineered versions of the vans appearing bearing different model names but all based on the same theme.

Second-generation models followed, produced from 1993 to 2006. However, for this feature we are concentrating on the third-generation Ducato, introduced towards the end of 2006, and after equivalent models from Citroën (Relay and Jumper) and Peugeot (Boxer) had arrived earlier that year. The engine line-up was then amended in 2010, and the range was facelifted in 2014.

Our vehicle for this feature is a 2008 Ducato motorhome, powered by Fiat/Iveco's 2.3-litre Multijet 130 diesel engine – a high-pressure common-rail unit.

One of the features of the Multijet engine, compared with earlier generations of diesel units (from Fiat and other manufacturers), is that multiple fuel injections per firing cycle are brought into play. This approach enables more complete combustion of the fuel and results in improvements in emissions and fuel consumption. In addition, the engine is more hushed in operation.

2287cc 4-cylinder DOHC 16v turbodiesel



For kindly allowing us to photograph his Ducato camper van, grateful thanks to Colin Wonnacott.

TYPICAL FAULTS

1. ROUGH RUNNING/MISFIRE, BLACK EXHAUST SMOKE
2. VERY POOR (GUTLESS!) PERFORMANCE
3. LACKLUSTRE PERFORMANCE
4. ELECTRICAL ACCESSORIES CONNECTED VIA 12-VOLT SOCKET NOT OPERATING

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is idea for use with this Ducato. It is a competent machine for working with many other makes and models too.

Guiding us around the diagnostic aspects of this Fiat's motor and its Bosch EDC 16C39 management system is Edward Haggar.

Preparation

The first step is to remove the plastic cover panel from the top of the engine, and store the cover out of harm's way where it cannot get trodden on. It will be noticed from the main engine photograph of the vehicle featured in this article that the cover is missing, and already corrosion (due to moisture in the vicinity of the top of the engine) has started to form around the fuel injectors. This could mean problems if ever they need to be removed – they can corrode in position. Note that at the very least special pullers, operating at 5 tonnes pressure (and more), may be required to remove the injectors.

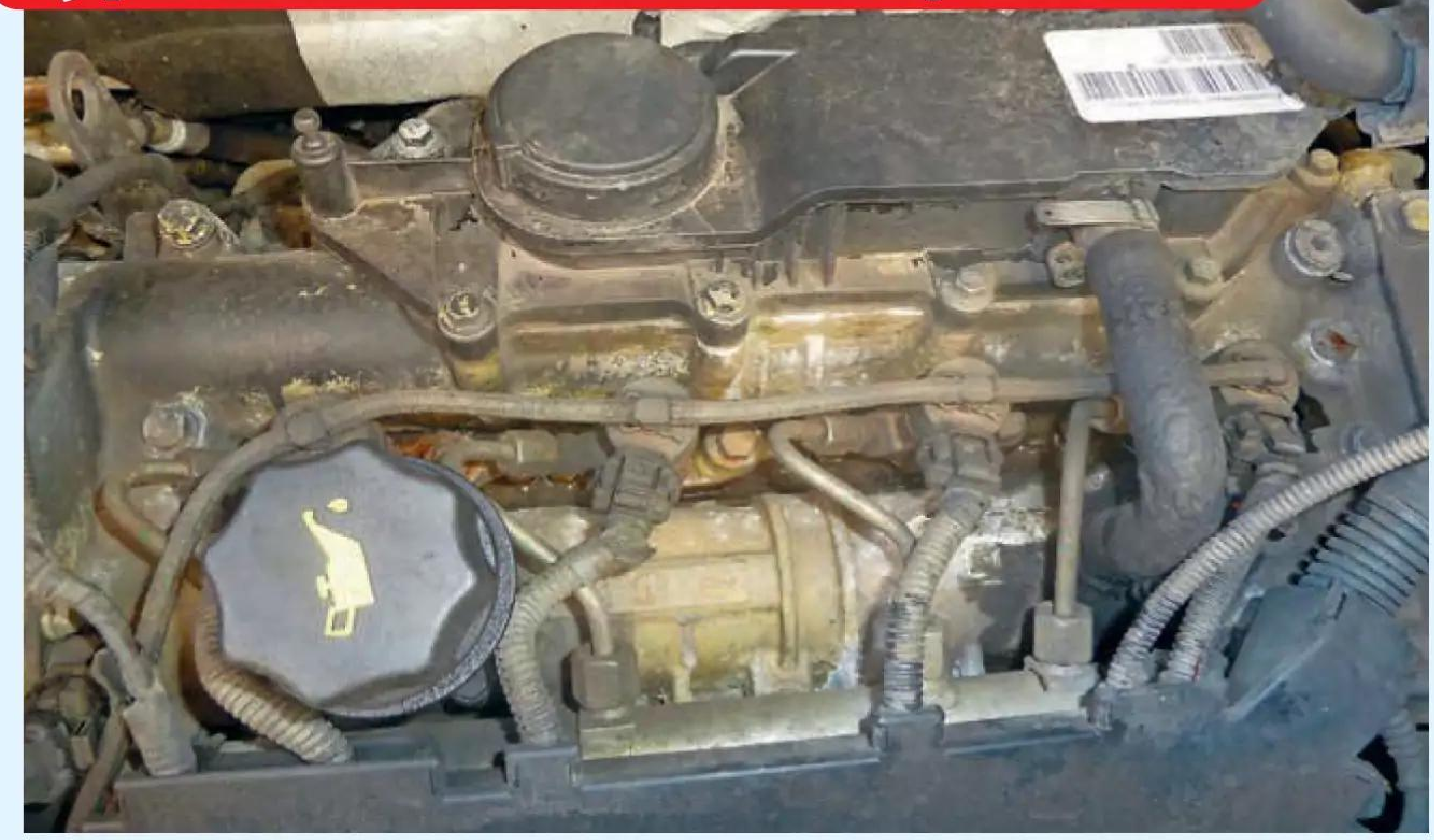
Ultimately, if corrosion has really taken hold, you may need to seek professional assistance in removing the injectors and/or glow plugs.

A camper wagon like the Ducato pictured here features an additional battery and numerous electrical sockets and lamps; for example, this particular caravan has six 12-volt sockets.

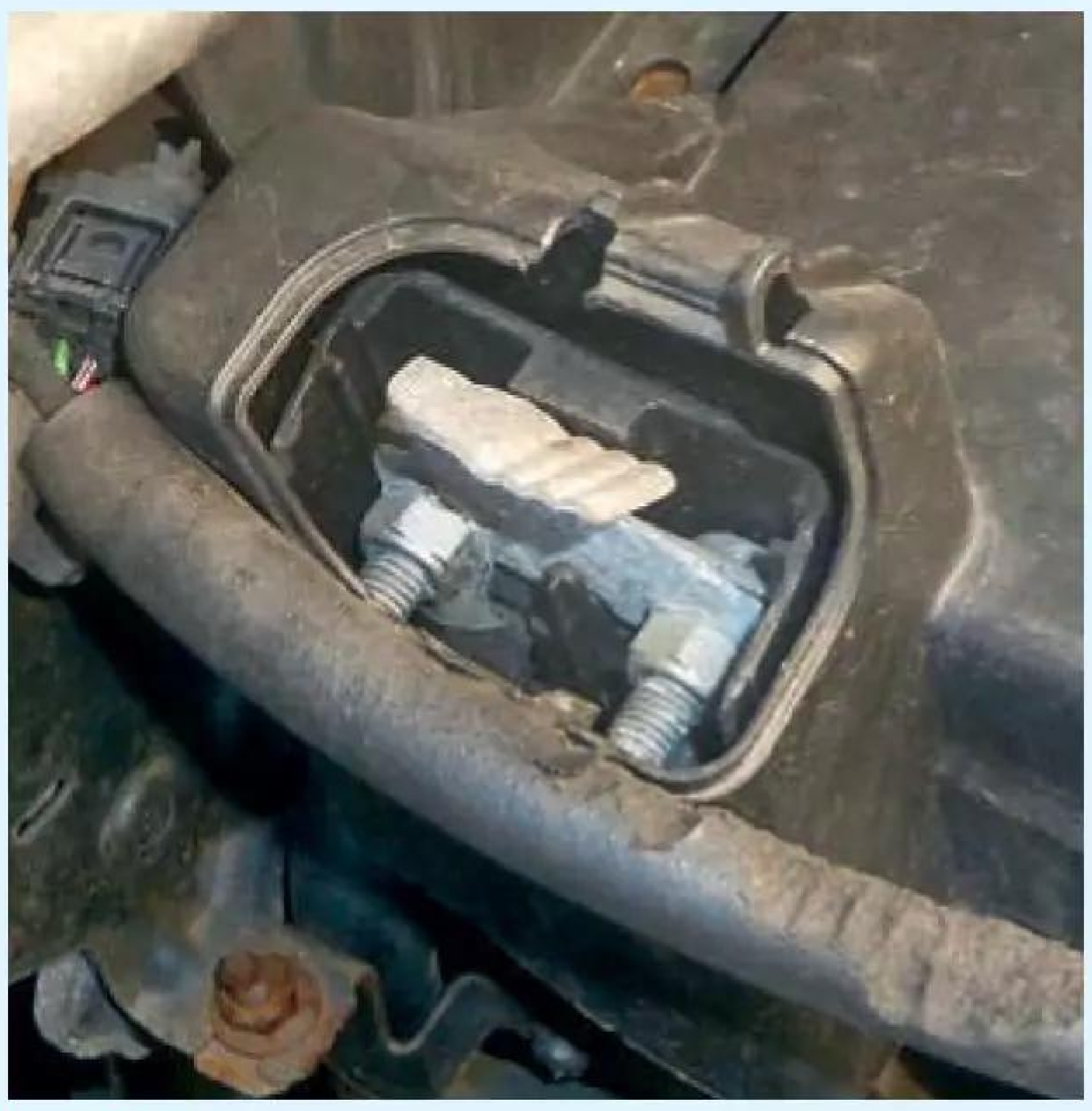
Although components are, of course, larger on a big vehicle like this, don't be daunted by the prospect of servicing it, for in general, maintenance is straightforward. Even a cambelt change can be undertaken at home with basic tools. However, Edward stresses that for safety reasons it is essential that a heavy-duty jack and axle stands are employed for raising and supporting the vehicle – never venture under any vehicle supported only by a jack or jacks – always use sturdy axle stands.

Edward explains that one of the most commonly-occurring problems with all camper vans that he gets called upon to deal with, is one of discharged/flat batteries. Since most such vehicles are only used in the summer months, it is inevitable that the batteries become 'dead' over time unless re-charged regularly. A frequent/regular re-charge, as part of a scheduled maintenance programme, eliminates this problem.

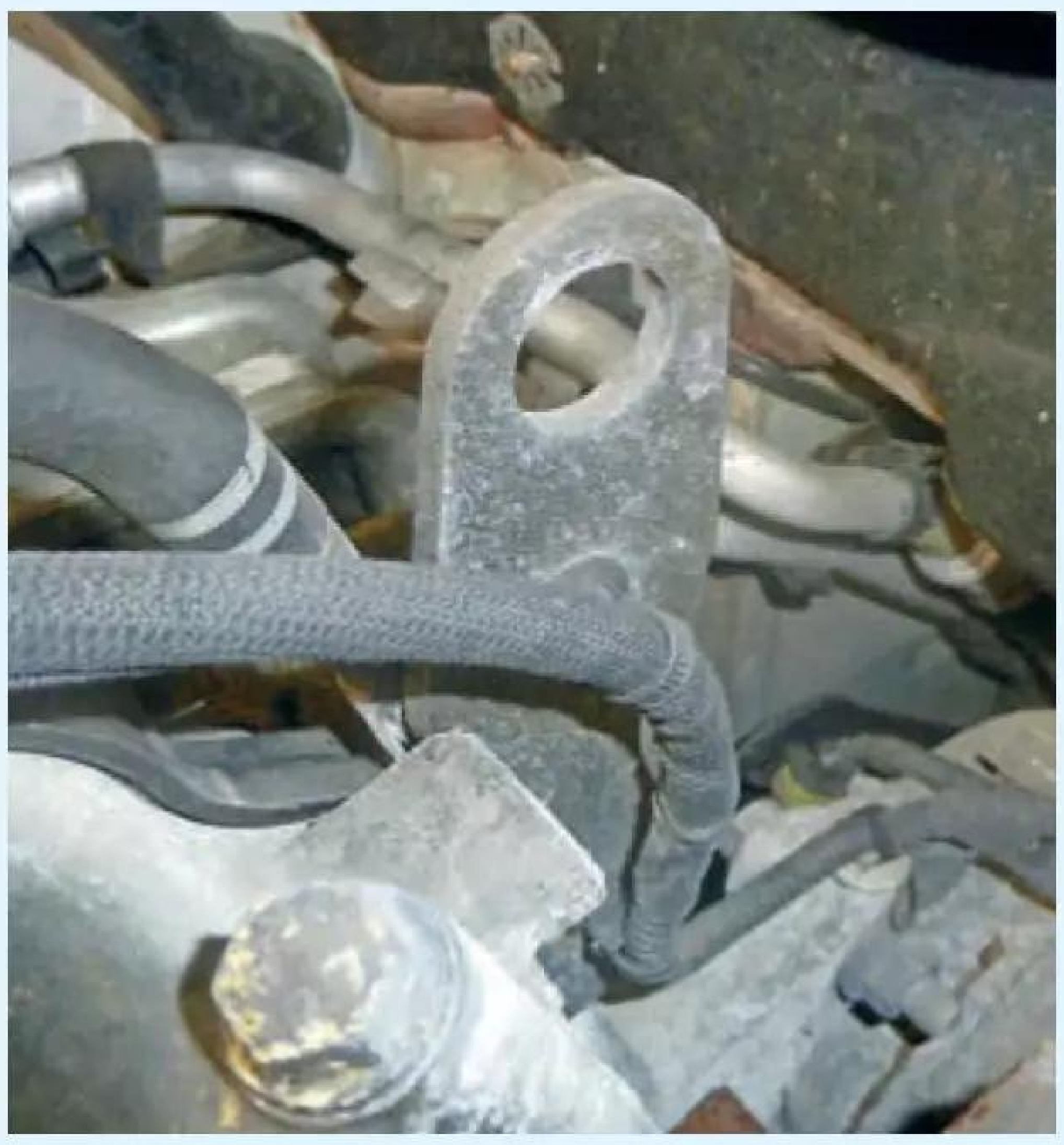
Typical Fiat Ducato components



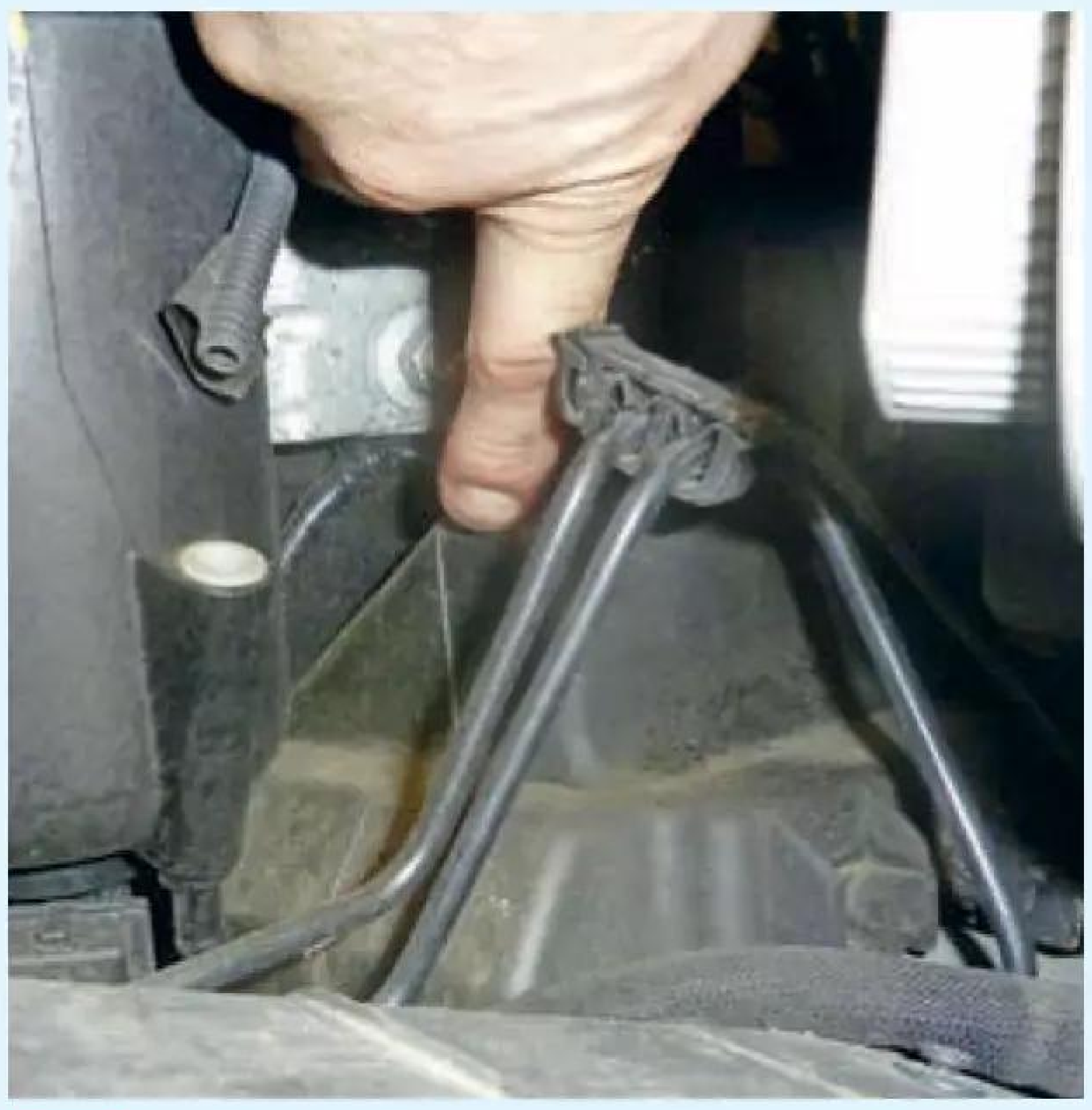
1 **The four fuel injectors are readily accessible at the top of the engine, once the plastic cover panel has been released and removed. Closely check the condition of the injector wiring and connectors, as well as the fuel feed pipes and their connections.**



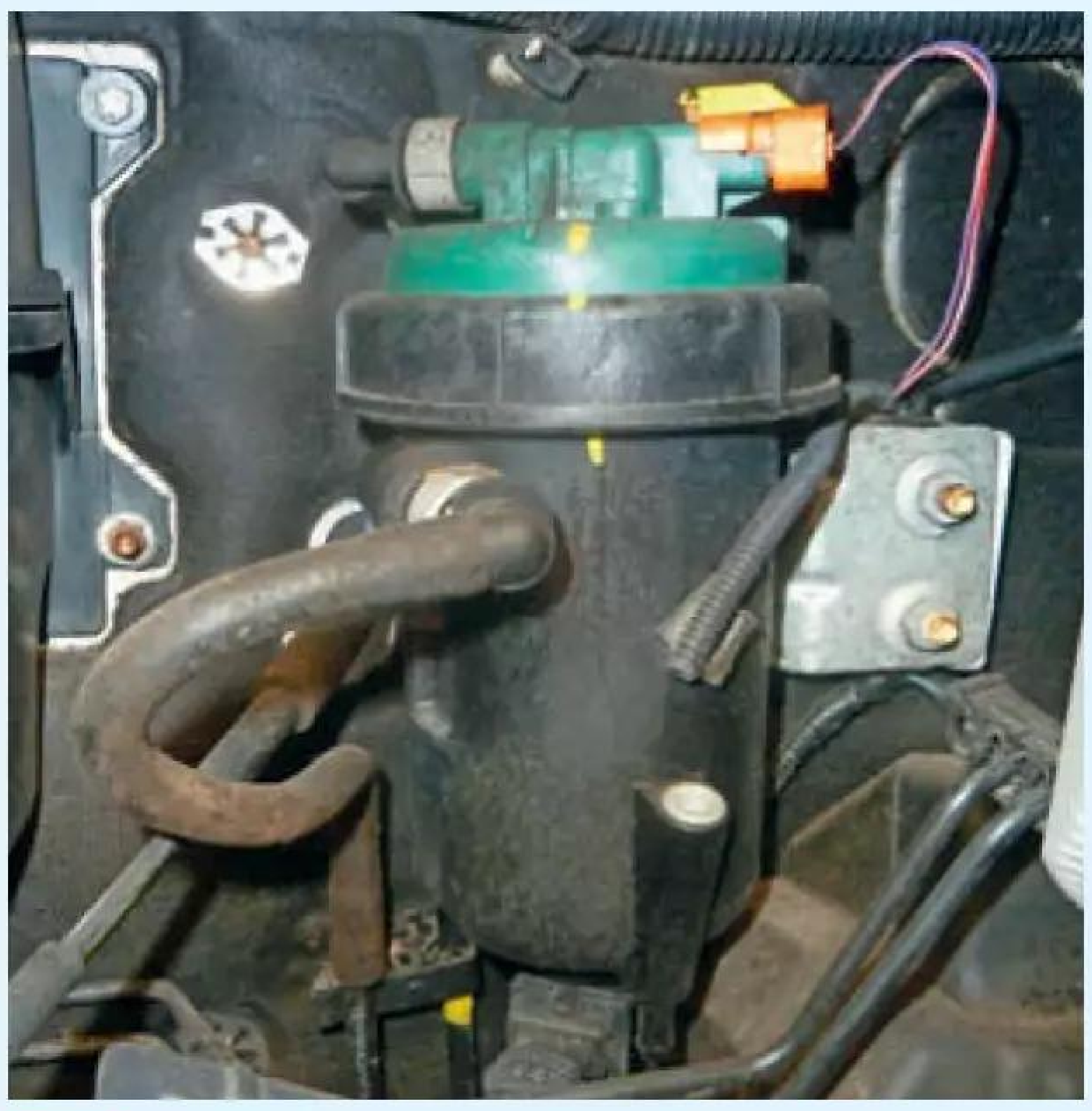
2 **The jump-start connection point is found on the left-hand side of the engine compartment, next to the underbonnet fusebox. If ever you need to jump start the vehicle, always use this purpose-designed connection point.**



3 **Edward advises that the engine lifting eye makes a good jump start/earth point. It's far better and safer to attach a jump cable here than directly to the vehicle's battery.**



4 **In the left-hand rear corner of the engine bay, close to the suspension turret, is the ABS (anti-lock brake system) pump and ECU assembly. Inspect the pipework and connections, also the electrical wiring, for evidence of deterioration.**



5 **Tucked away but not too difficult to reach and deal with is the bulkhead-mounted fuel filter. No hand primer is fitted, but we advise filling the filter with diesel fuel when installing it will help avoid prolonged cranking to re-start the engine.**

⇨

ENGINE MANAGEMENT

The Bosch EDC 16C39 management system used on this Fiat incorporates these primary components:

- Multi-plug ECU.
- 4 x solenoid type fuel injectors.
- Glow plugs.
- High-pressure fuel pump driven via cambelt.
- DPF system.
- DPF pressure and temperature sensor.
- Air mass sensor, mounted in air trunking.
- ABS pump and ECU combined.
- Vacuum-operated turbo wastegate.
- Negative and positive jump-start points in engine bay.
- Cam sensor picking up cam position.

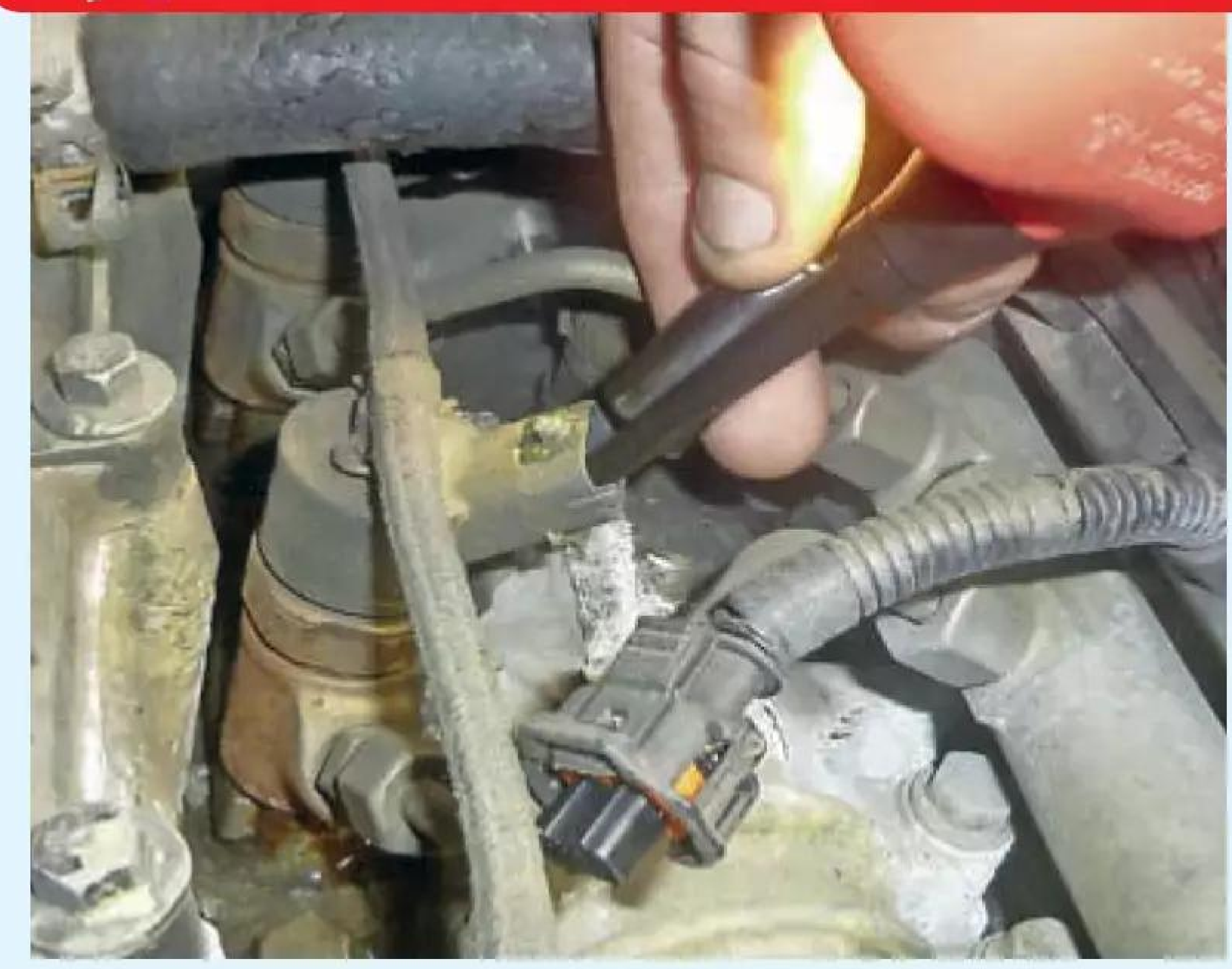
Fault 1:

FUEL INJECTOR FAILURE

Our first fault gives itself away by the engine running roughly – it feels as if it is misfiring – accompanied by excessive black smoke from the exhaust. This may be due to injector failure.

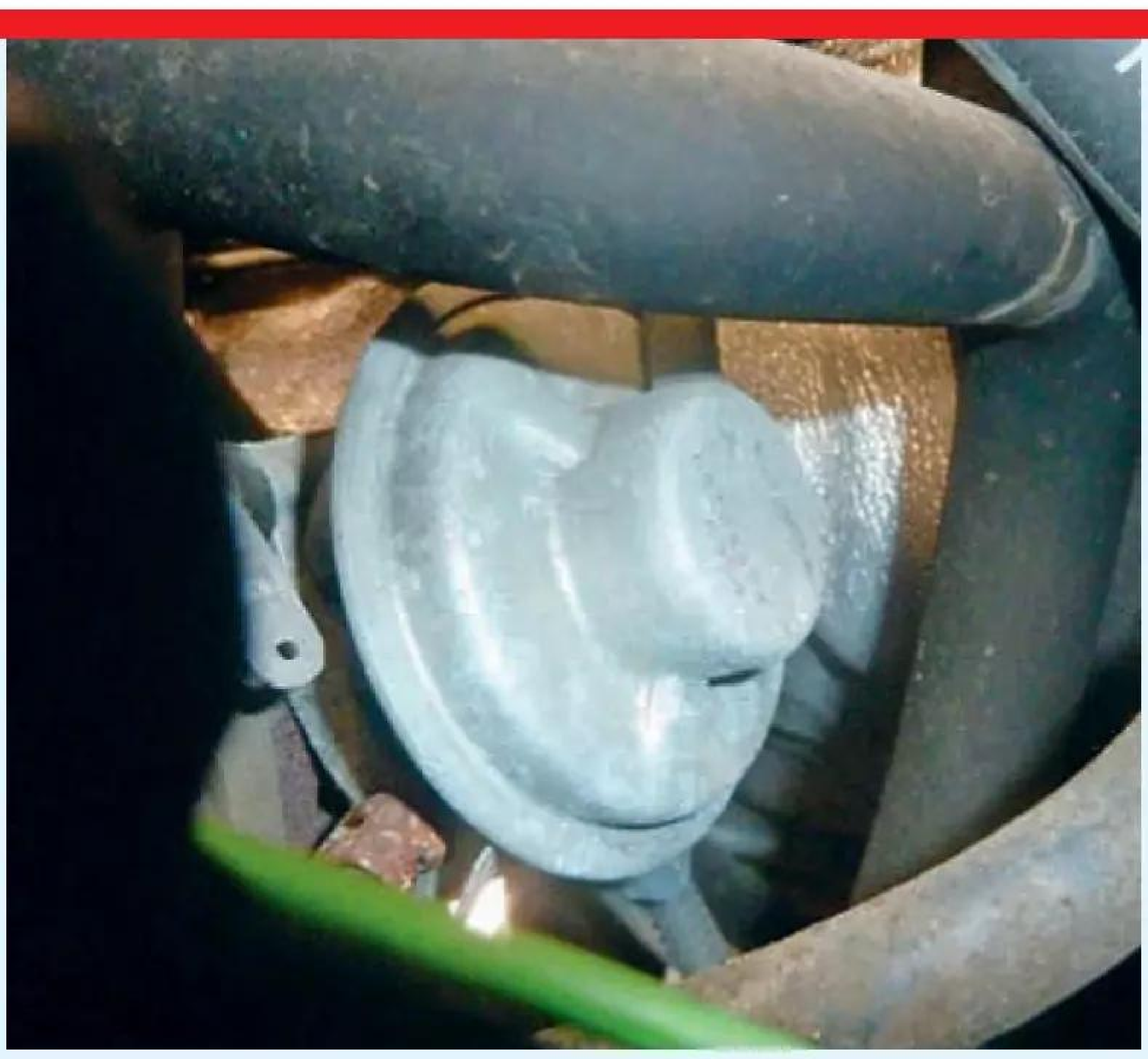
As mentioned in our 'Preparation' section, if the engine's top cover goes missing (and sometimes, even if it doesn't), moisture can collect around the fuel injectors, encouraging corrosion to form and, in time, adversely affecting injector operation. It can also make the injectors near-impossible to remove. A simple resistance test of the injector can

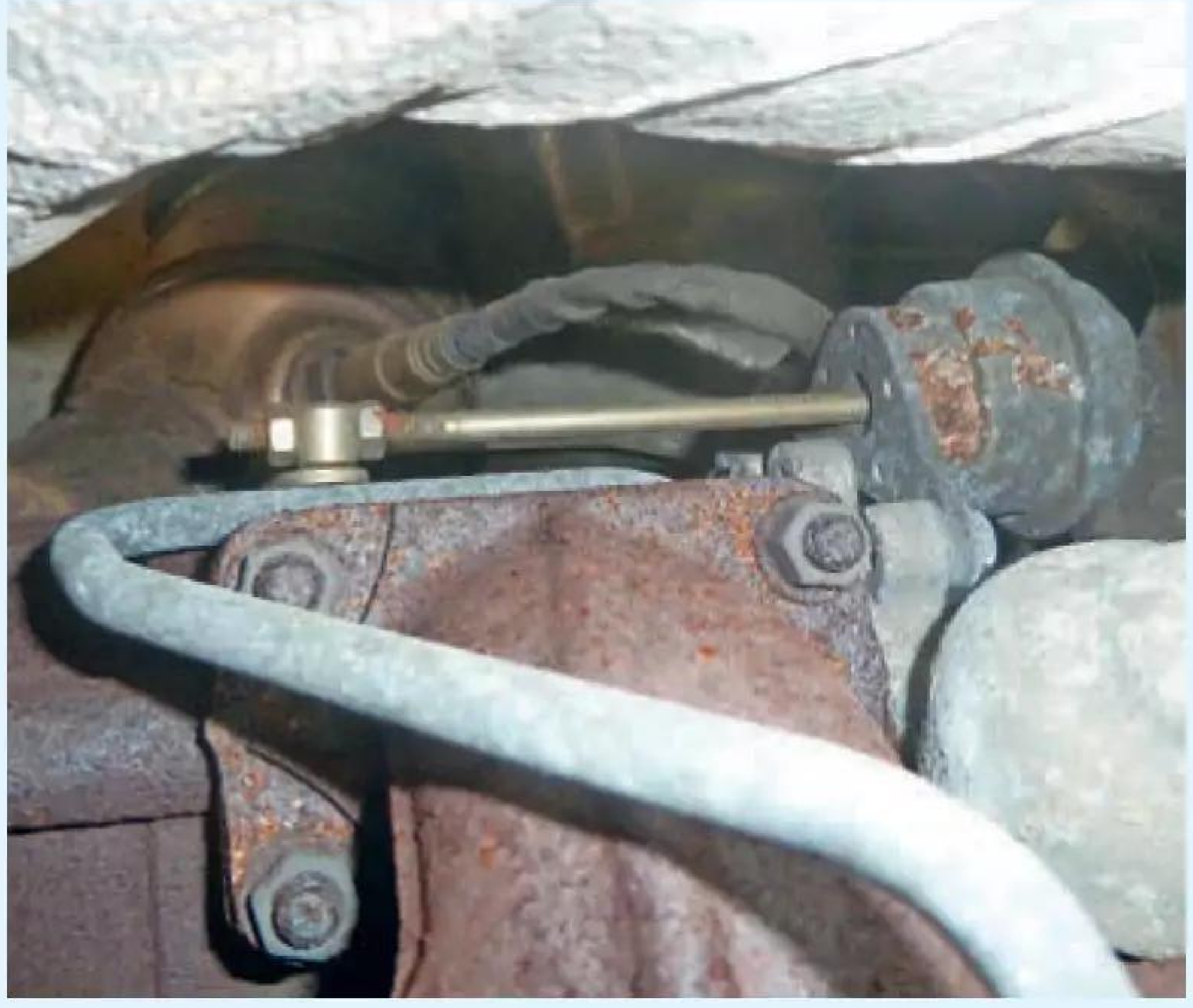
Typical Fiat Ducato components



6 ◀ **Use a multimeter to check injector resistance, having first detached the injector's electrical connector. While this is separated, inspect the plug/socket assembly and ensure that the connections are clean, dry and in good condition.**

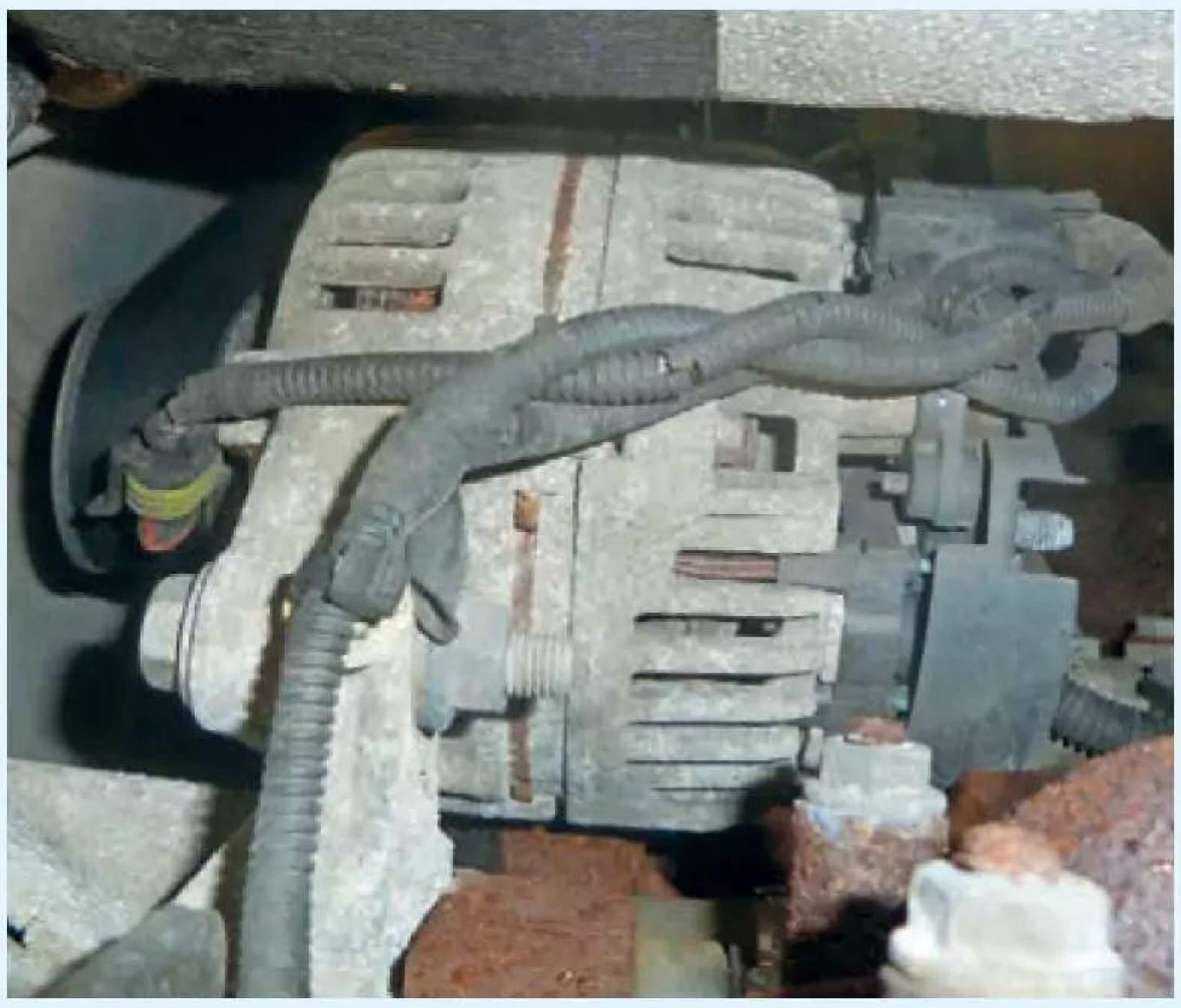
7 ▶ **Hiding amidst a variety of hoses is the EGR valve and cooler assembly. The EGR valve serves to recirculate exhaust gases back into and through the engine, helping to minimise harmful Nitrogen Oxide (NOx) emissions.**

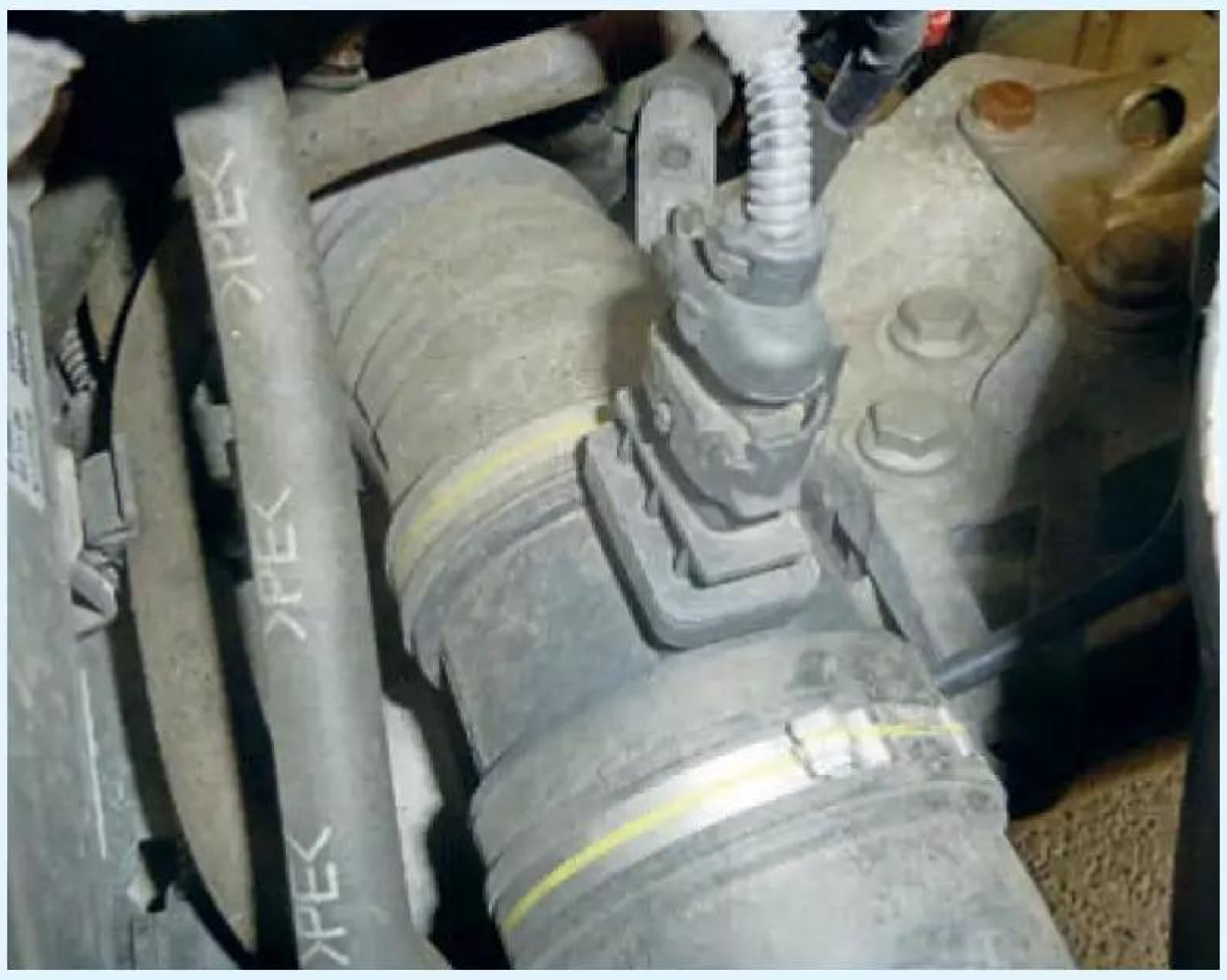




8 ◀ **Hidden away at the rear of the engine and low down within the compartment, is the turbocharger assembly and its actuator rod. It's essential that the engine oil and filter are renewed frequently, to provide clean lubricant to the turbo bearings.**

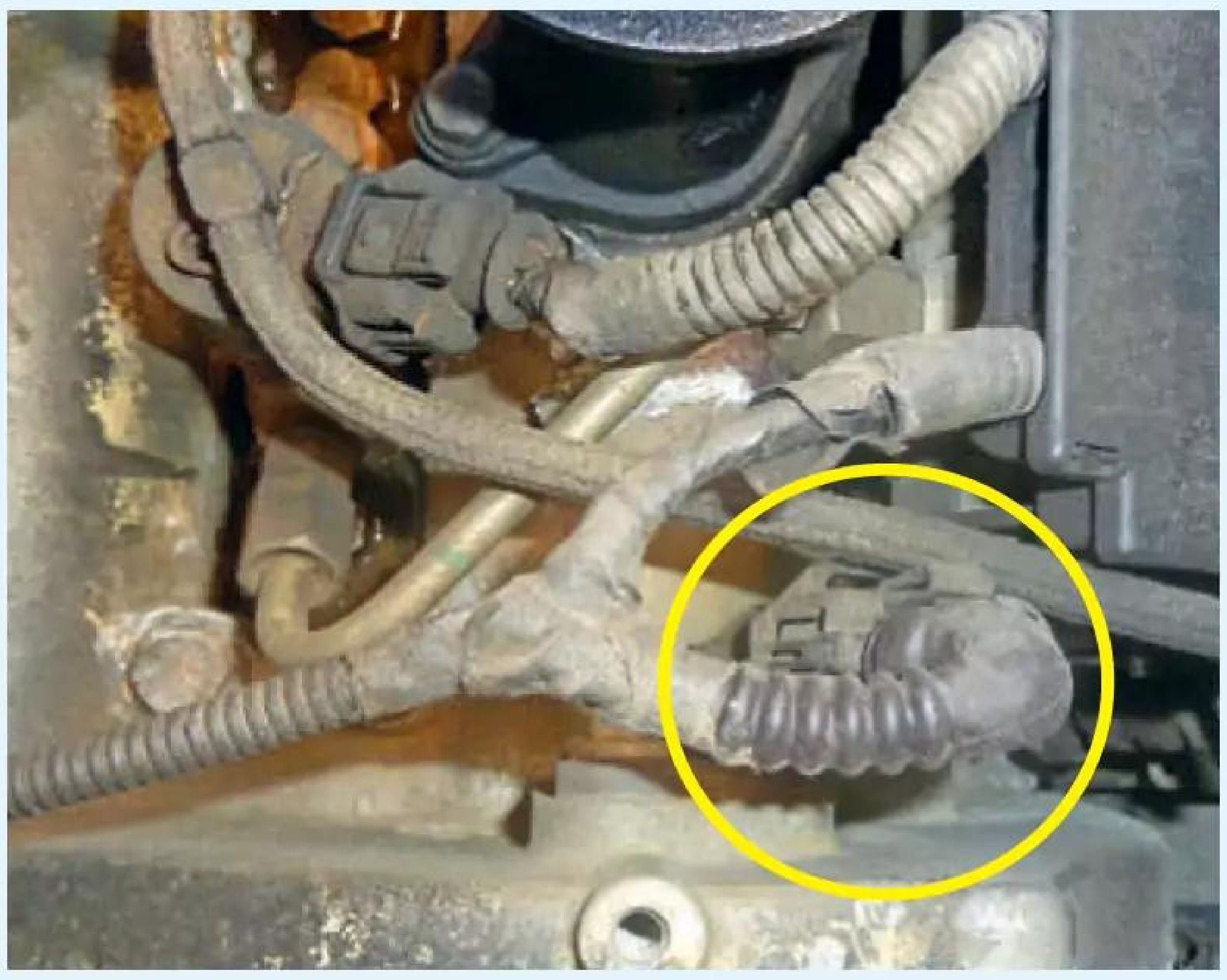
9 ▶ **The alternator plays a vital role in keeping the vehicle's battery charged to properly serve the electronic management system, and is located at the rear of the engine bay, on the right-hand side. Check that its drive belt is sound and correctly tensioned.**





10 ◀ **The air mass sensor measures the mass of air passing into the engine, relaying this information to the ECU which in turn uses the data as one of the parameters for calculating/adjusting fuelling levels at any given moment.**

11 ▶ **The camshaft position sensor is located on top of and towards the back of the cylinder-head, and is visible here just to the right of the centre of the photo (circled). Check the wiring and electrical connection to the sensor.**



give a basic idea, but if available, a live data check, looking at cylinder balance, will indicate the failing cylinder.

Edward adds that he has come across one of these engines in which the plug/socket wiring and injector pins had completely rusted away, due to being immersed in water for a long period of time. As mentioned previously, if the injectors are seized in the engine, a special puller may be required to free them.

As a first step, Edward recommends drying out the water, then soaking the area around the injector with penetrating oil, leaving overnight and trying removal the next day. If the injector refuses to budge, it is worth considering using the services of one on the many mobile operators who have the requisite pullers, should they be needed.

The fuel injectors are coded, so on installation, suitable diagnostics coding equipment is required.

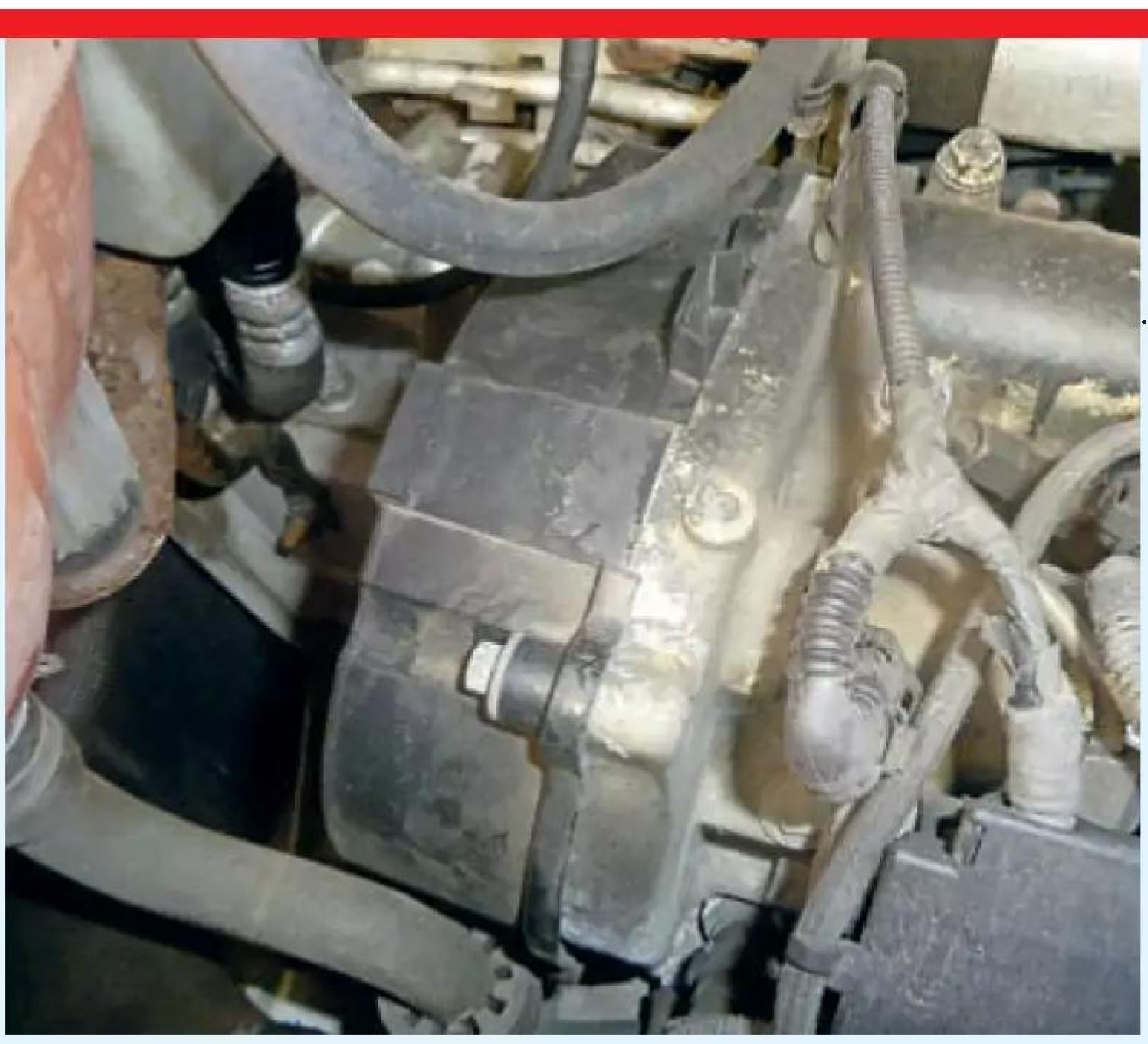
Fault 2:

BLOCKED DIESEL PARTICULATE FILTER

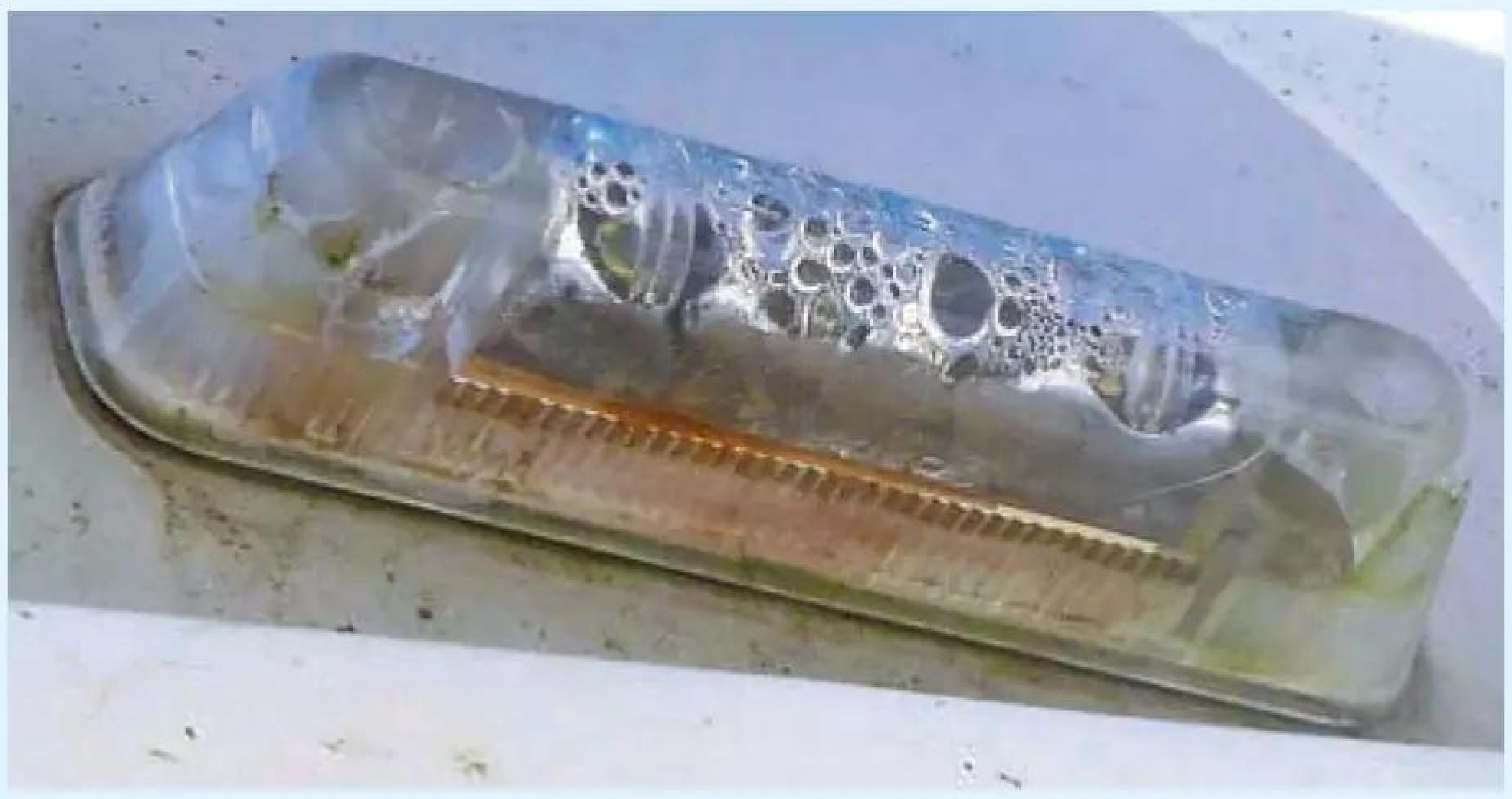
When our second fault occurs, the vehicle's performance levels will be terrible. If available diagnostic equipment allows, carry out a Diesel Particulate Filter (DPF) soot level check. As a rule of thumb, anything below 25 grams is OK, but levels higher than this indicate that attention is required.

Note that stop-start short journeys can cause the DPF to block more quickly, and so can running with a low fuel level; this will prevent regeneration of the DPF from taking place automatically.

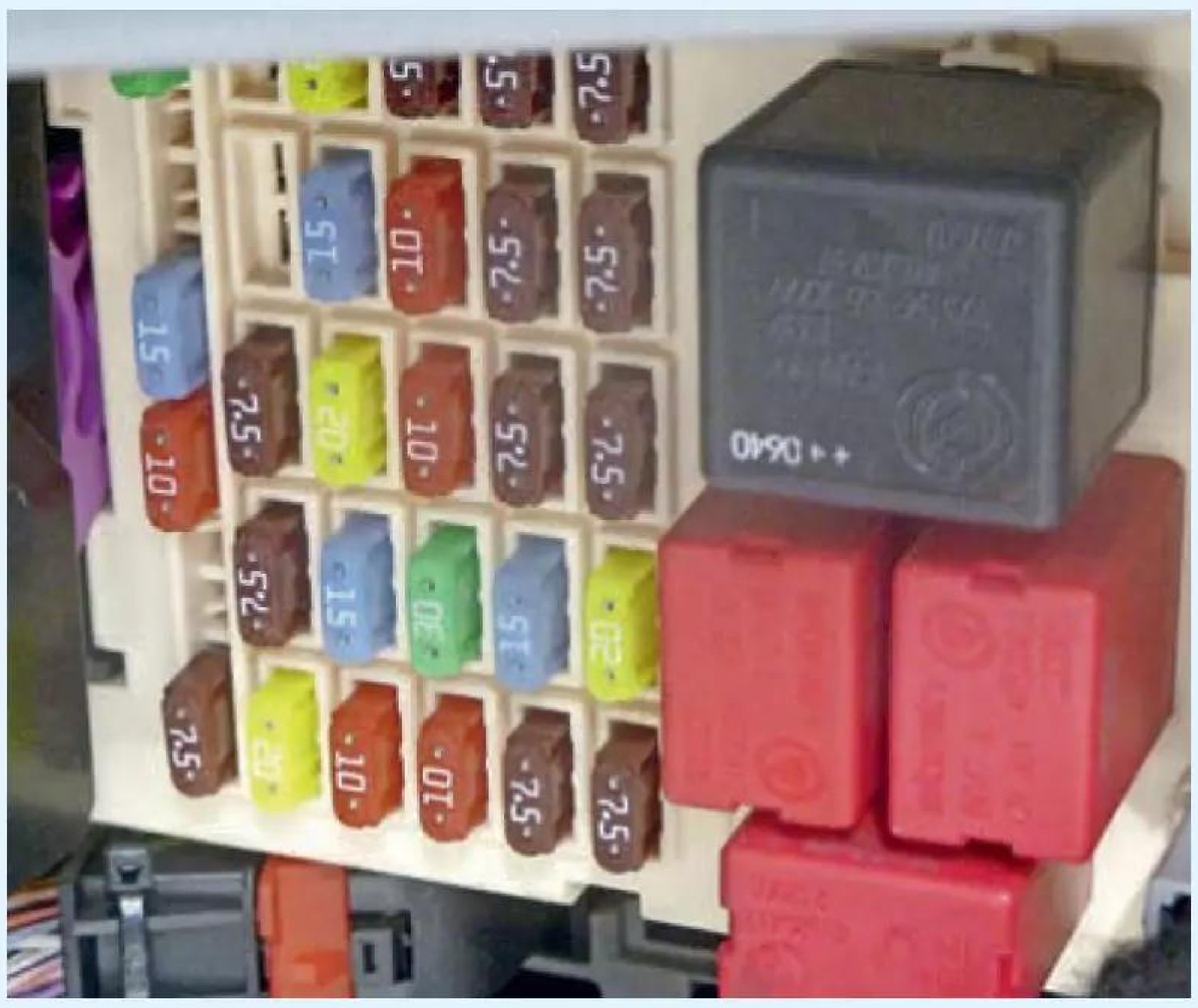
Edward points out too that a filter registering more than 70 grams of soot will either need to be renewed, or possibly cleaned in situ. He adds that a DPF was a standard feature on Ducatos from the 2008 model year.



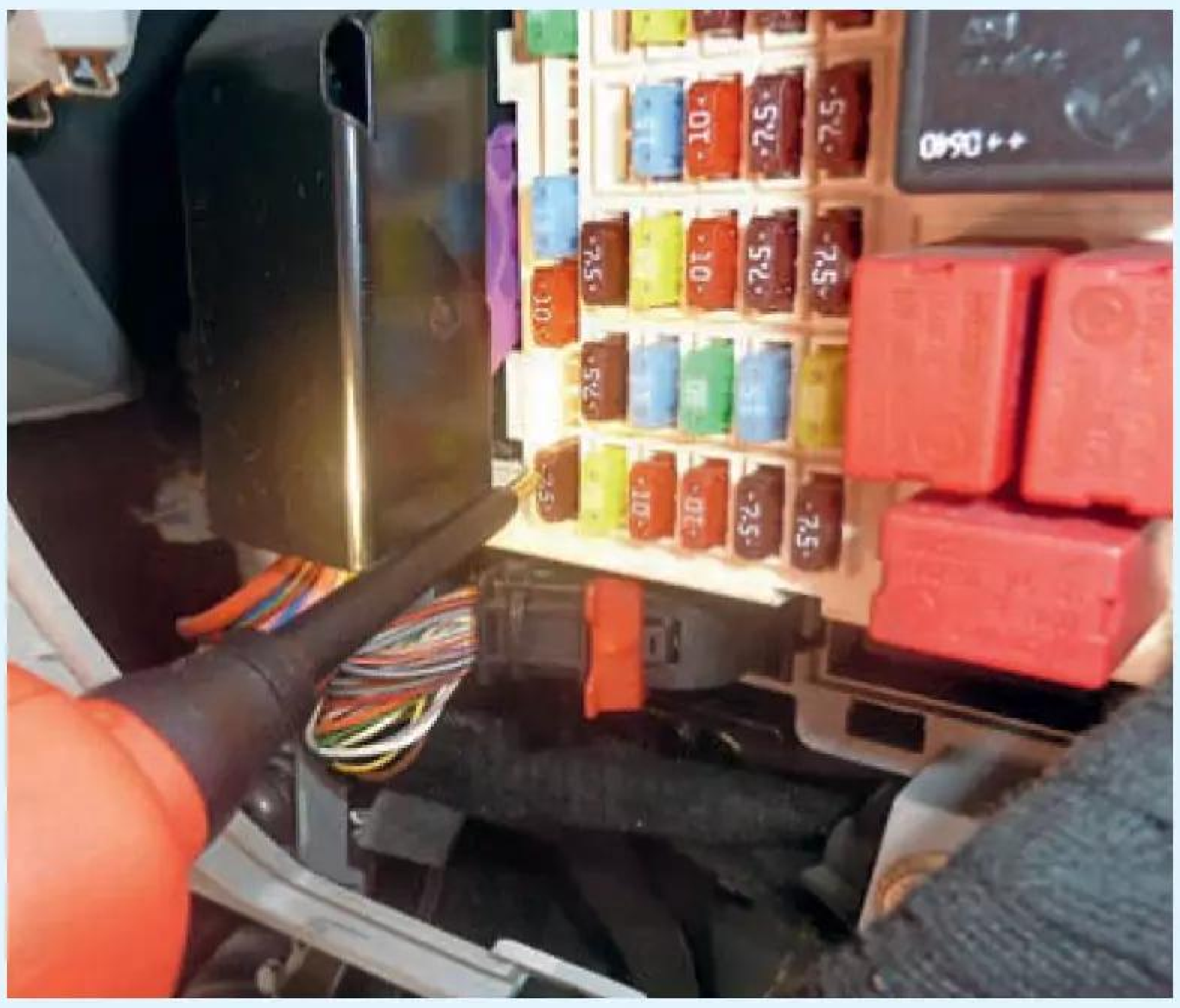
12 ◀ **Hidden beneath this cover is the camshaft drive belt (timing belt). The belt should be renewed at least as often as specified by Fiat, to avoid belt breakage and possible engine damage. While you're in this area, always check the water pump for signs of wear and leakage. If in doubt, renew it.**



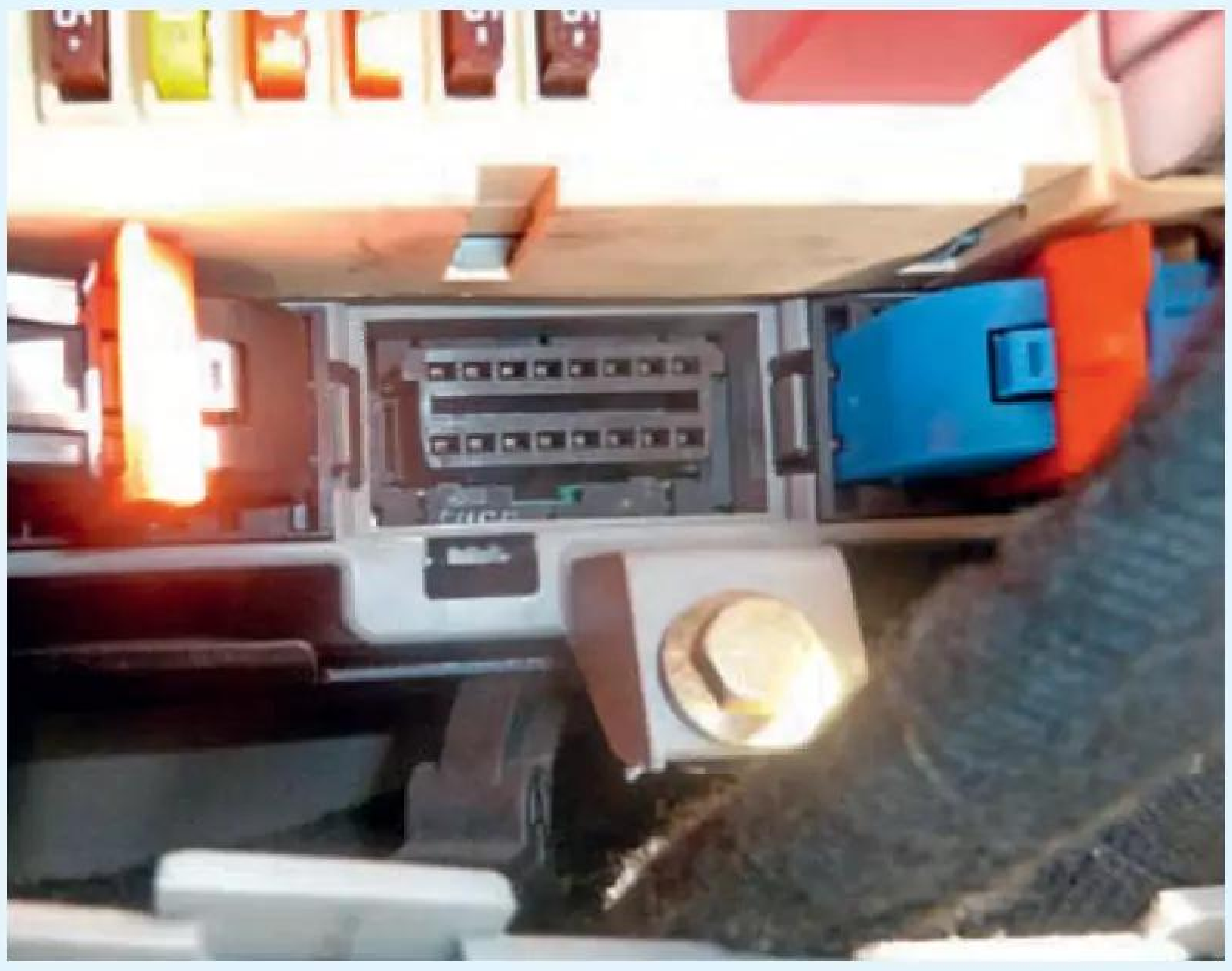
13 ▶ **The ingress of moisture into lamp assemblies is not unknown. Remove the cover, dry out the moisture, check/clean the connections and bulb and re-assemble, sealing the lamp's cover using waterproof sealant.**



14 ◀ **Positioned to the right-hand side of the steering wheel, and normally hidden by a cover panel, is this fuse and relay box assembly. It is readily accessible once the cover panel has been removed.**



15 ▶ **In this shot, Edward is using a multimeter to test a fuse for available voltage. However, he points out that an 'old school' test lamp could also be used, as an alternative.**



16 ◀ **The Ducato's diagnostic socket is housed within the fusebox, inside the vehicle. Edward advises caution when working in this area; be careful when making connections because pin damage is possible.**

17 ▶ **A multimeter is a very useful tool for checking voltages and resistance readings, and here Edward is applying his to check electrical resistance within the Ducato's cigarette lighter/12-volt socket assembly.**

⇨

Fault 3:

CHOKED DIESEL FUEL FILTER

If this fault occurs, similar symptoms to a blocked DPF may occur, notably with poor driveability/performance being evident. Strangely, when the engine is warm the symptoms may lessen.

Another aspect to this trouble is that, with camper vans usually covering relatively few miles, often they are not fully serviced as they should be.

Edward says that he always starts with basic fault-finding, including establishing when the fuel and air filters were last renewed, whether the vehicle has been run consistently on low grade fuels, etc. He explains that if not renewed regularly, diesel fuel filters tend to 'thicken' internally, thus restricting fuel flow through the unit. Eventually this may result in a non-start situation as diesel fuel struggles to reach the engine.

If carrying out fault-finding at home, you could simply bypass the fuel filter altogether to see if any improvements arise; simple but effective.

Edward prefers to use his diagnostic equipment to look at fuel pressure, which may fluctuate if the filter is clogged. He has occasionally been called out to owners who had even gone to the extent of installing new fuel rail pressure sensors to try to fix this problem, but they had ignored the basics...

When fitting a new filter, always use a high-quality or OE component.

Fault 4:

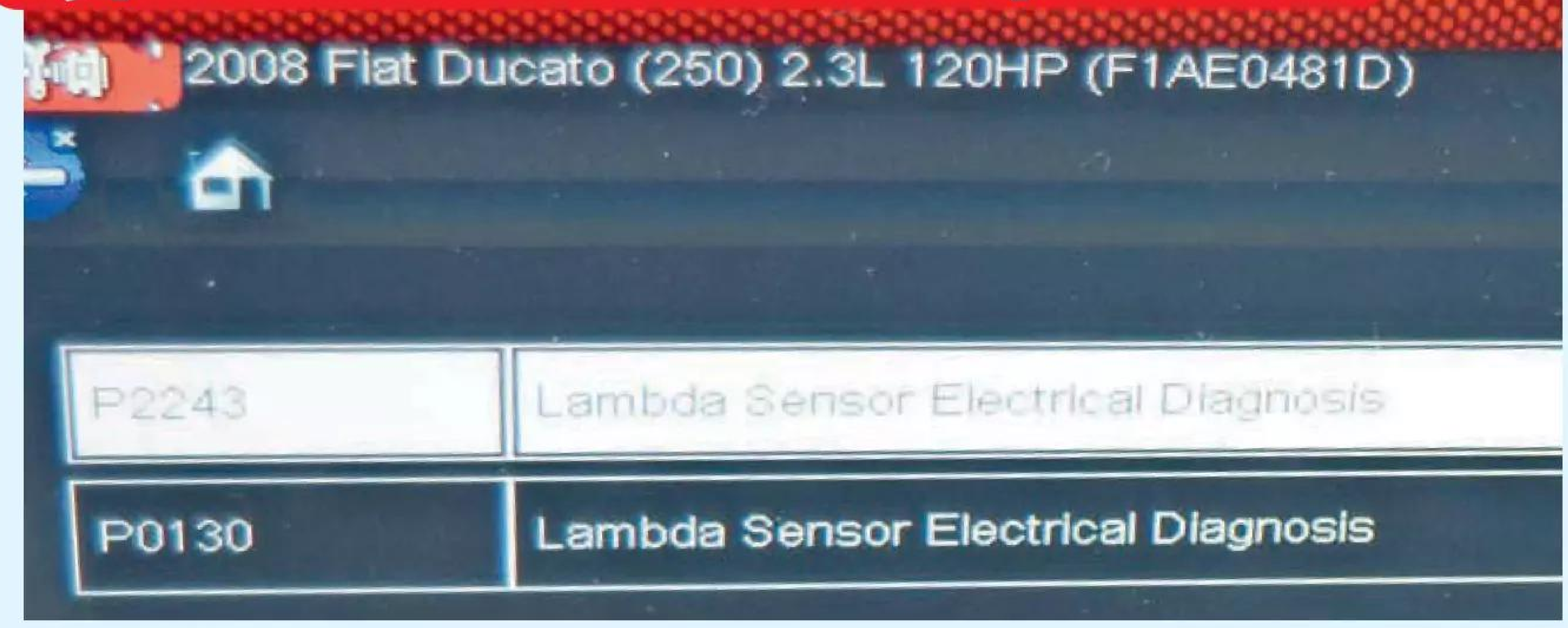
BLOWN FUSE AND/OR ELECTRICAL FAILURE

If the driver reports that their plug-in sat-nav system is not working, and their phone is not being charged, and anything else that plugs into one of the 12-volt sockets is not operating, first apply a volt meter to check that 12-volts/battery voltage is present on the centre pin at the base of the socket.

If there's no voltage, it's likely that the a fuse has blown – but remember that it is rare for a fuse to simply blow without there being a reason! It could be that the socket was overloaded, or that part of the charger has broken away and caused the unit to short and blow the fuse.

As Edward points out, earlier camper vans tend to feature a multitude of such sockets, so it's worth testing each one for signs of shorting and damage.

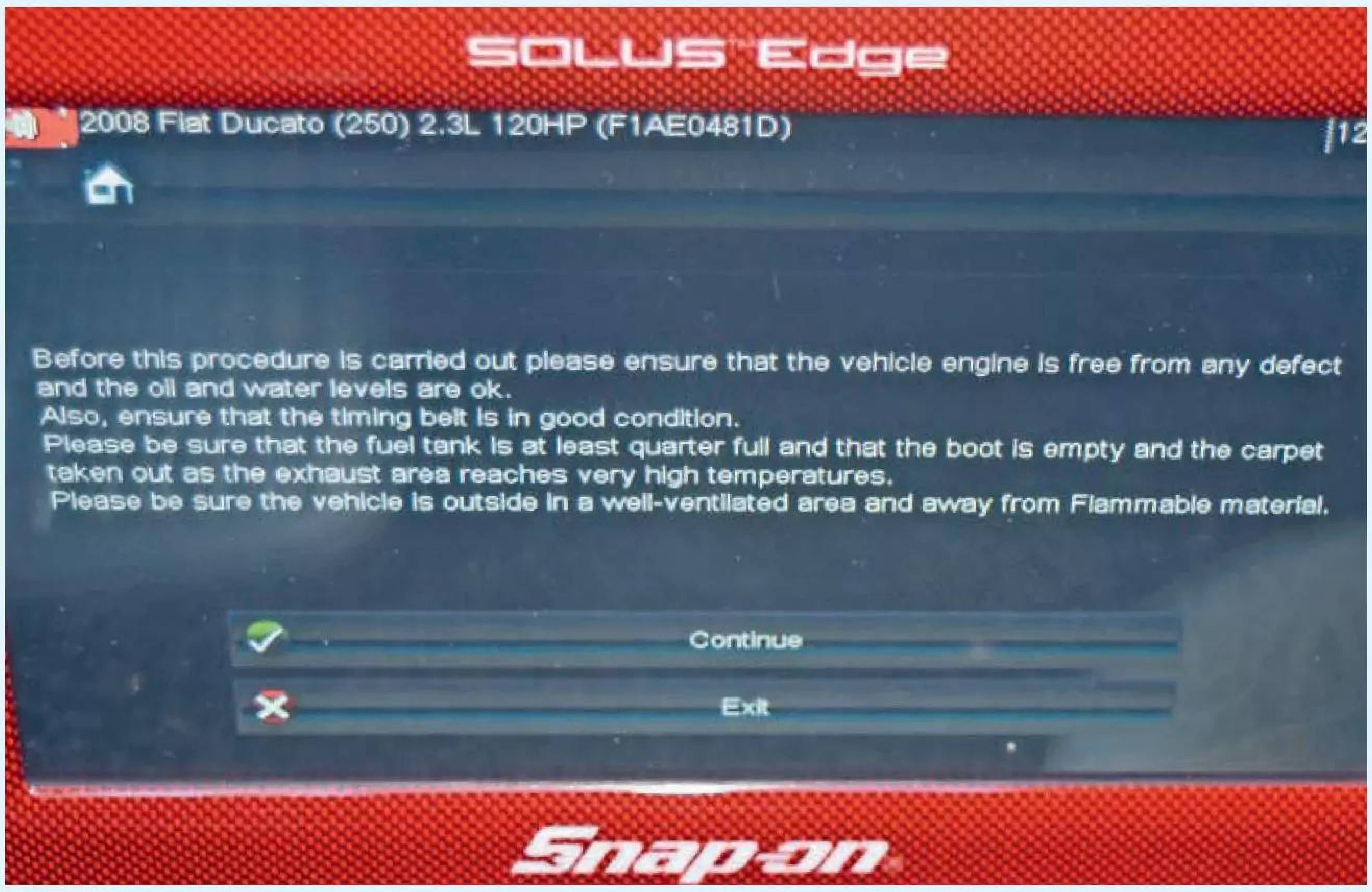
Typical Fiat Ducato components



2008 Fiat Ducato (250) 2.3L 120HP (F1AE0481D)

P2243	Lambda Sensor Electrical Diagnosis
P0130	Lambda Sensor Electrical Diagnosis

18 This screen shot on the Snap-on SOLUS Edge diagnostic tool is displaying an oxygen/O2/Lambda sensor fault code. This equipment is also ideal for showing live data and for carrying out a multitude of in-depth diagnostic checks on the Ducato.



2008 Fiat Ducato (250) 2.3L 120HP (F1AE0481D)

Before this procedure is carried out please ensure that the vehicle engine is free from any defect and the oil and water levels are ok.
Also, ensure that the timing belt is in good condition.
Please be sure that the fuel tank is at least quarter full and that the boot is empty and the carpet taken out as the exhaust area reaches very high temperatures.
Please be sure the vehicle is outside in a well-ventilated area and away from Flammable material.

19 One of the extremely useful attributes of the SOLUS Edge tool is that it can be used to 'force' regeneration of the DPF system on modern diesel engines such as the Multijet motor used in the Ducato – as indicated in this photograph.

Technical Specs

Actual values

Component	Value
Fuel injector	0.6 ohms
Glow plug	0.6 ohms
Crank sensor	350 ohms
Cam sensor	5-volt supply
EGR valve actuator	3.3 ohms

To bleed fuel system,
turn ignition on and off 10 times

USEFUL SERVICE DATA

Below are the official recommended change intervals for the various components. However, Edward advises that these service/change intervals are at least halved.

Service intervals:
Officially every 28,000 miles or 28 months, whichever comes first.

Cambelt: Renew at least every 112,000 miles or 60 months.

Fuel filter: Officially renew every 28,000 miles or 28 months.

Air filter: Officially renew every 28,000 miles or 28 months.

Engine oil: 28,000 miles or 28 months, whichever comes first.

Oil Type: SAE 5W-30 fully-synthetic.

Sump plug torque setting: 22Nm.

Brake fluid: Every 24 months.

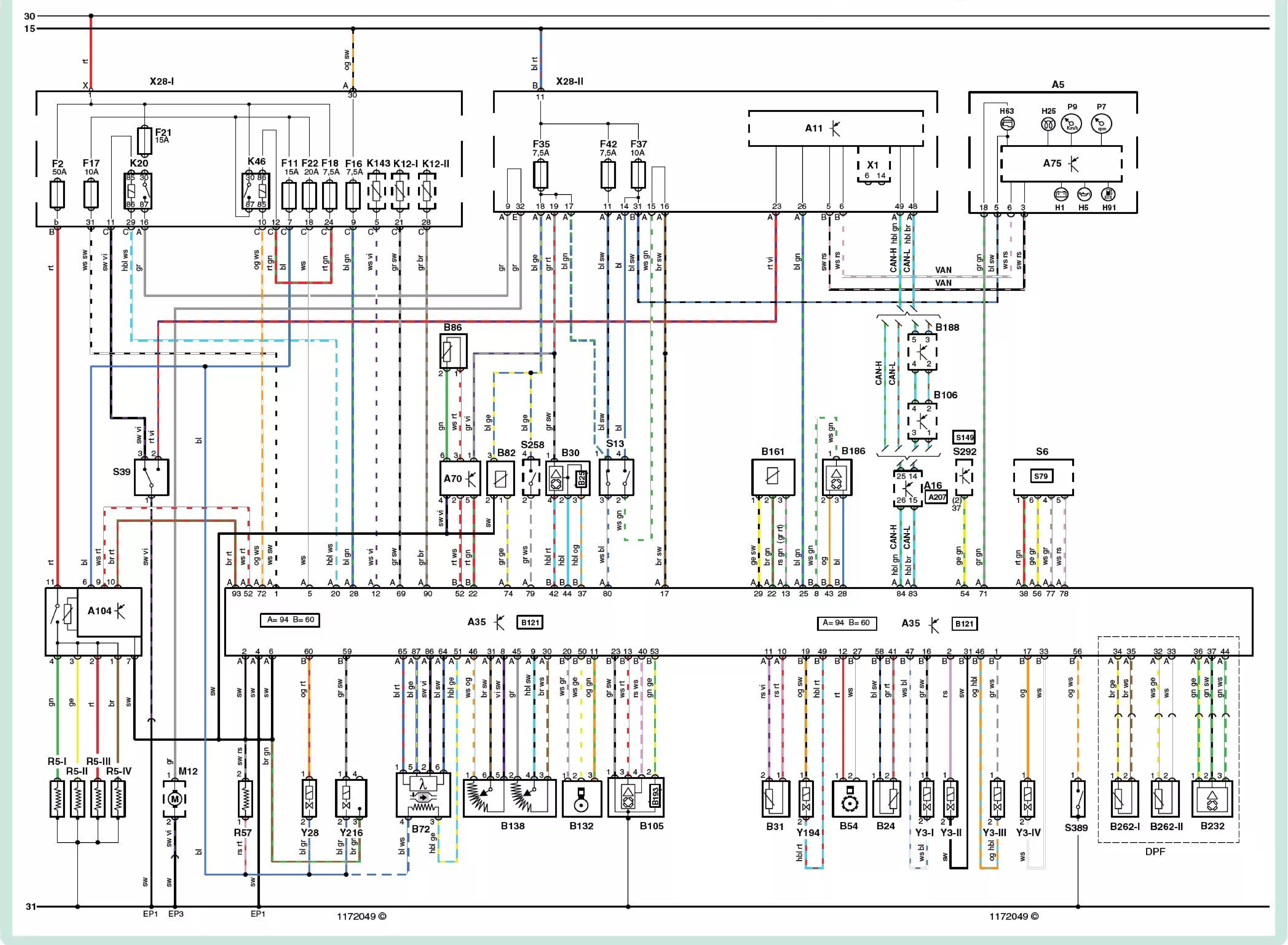
Capacity ('service' fill): 6.5 litres.

Oil filter torque setting: 25Nm.

Injection sequence: 1-3-4-2.

Autodata
www.autodata-group.com

FIAT DUCATO CIRCUIT DIAGRAM


30
15
31
X28-I
X28-II
A5
F2 50A
F17 10A
K20
F21 15A
K46
F11 15A
F22 20A
F18 7,5A
F16 7,5A
K143
K12-I
K12-II
F35 7,5A
F42 7,5A
F37 10A
A11
X1
H63
H25
P9
P7
A75
H1
H5
H91
VAN
CAN-H
CAN-L
B86
B188
B106
S149
S292
S6
S79
S39
A70
B82
S258
B30
B25
S13
B161
B186
A16
A207
A104
A35
B121
A= 94 B= 60
R5-I
R5-II
R5-III
R5-IV
M12
R57
Y28
Y216
B72
B138
B132
B105
B193
B31
Y194
B54
B24
Y3-I
Y3-II
Y3-III
Y3-IV
S389
B262-I
B262-II
B232
DPF
EP1
EP3
1172049 ©

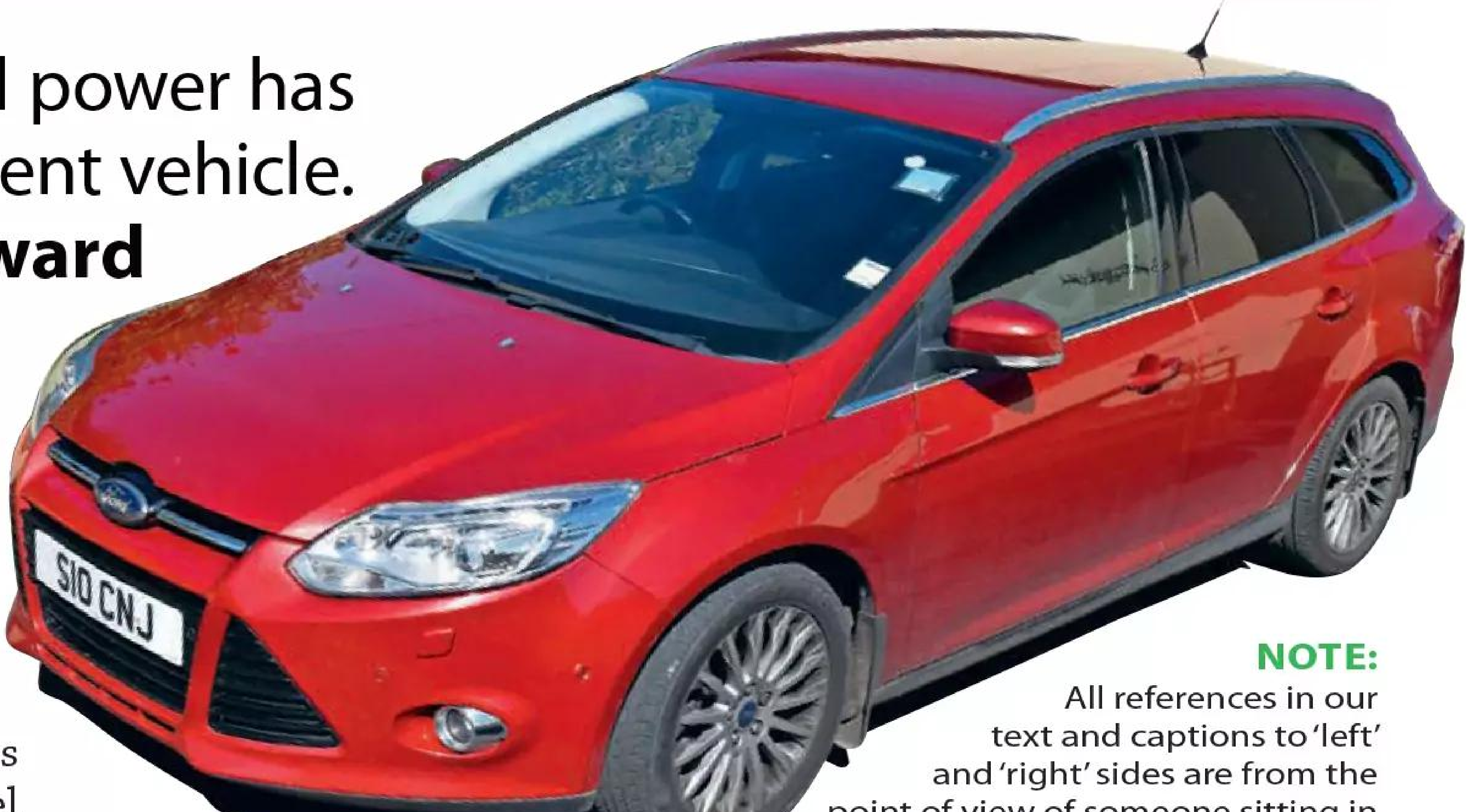
CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A16	ABS CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A70	ENGINE OIL LEVEL CONTROL MODULE
A75	INSTRUMENTATION CONTROL MODULE
A104	GLOW PLUG CONTROL MODULE
A207	ELECTRONIC STABILITY PROGRAM (ESP) CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B72	HEATED OXYGEN SENSOR (HO2S)
B82	FUEL/WATER SEPARATOR SENSOR
B86	ENGINE OIL LEVEL SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B106	STEERING POSITION SENSOR
B121	BAROMETRIC PRESSURE (BARO) SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B188	YAW RATE SENSOR
B193	TURBOCHARGER/SUPERCHARGER (TC/SC) BOOST AIR TEMPERATURE SENSOR
B232	DIESEL PARTICULATE FILTER (DPF) PRESSURE SENSOR
B262-I	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR | **1**
B262-II	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR | **2**
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
EP	EARTH POINT
F	FUSE
H1	ALTERNATOR WARNING LAMP
H5	ENGINE OIL PRESSURE WARNING LAMP
H25	GLOW PLUG WARNING LAMP
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
H91	FUEL FILTER WARNING LAMP
K12-I	ENGINE COOLANT BLOWER MOTOR RELAY | **1**
K12-II	ENGINE COOLANT BLOWER MOTOR RELAY | **2**
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
M12	FUEL PUMP (FP)
P7	TACHOMETER
P9	VEHICLE SPEEDOMETER
R5-I	GLOW PLUG | **1**
R5-II	GLOW PLUG | **2**
R5-III	GLOW PLUG | **3**
R5-IV	GLOW PLUG | **4**
R57	CRANKCASE BREATHER HEATER
S6	COMBINATION SWITCH
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S39	INERTIA FUEL SHUT-OFF (IFS) SWITCH
S79	CRUISE CONTROL MASTER SWITCH
S149	AC MASTER SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S292	AC/HEATER FUNCTION CONTROL PANEL
S389	ENGINE OIL PRESSURE SWITCH
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X28-I	FUSE BOX/RELAY PLATE, ENGINE BAY
X28-II	FUSE BOX/RELAY PLATE, ENGINE BAY 1
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y3-IV	INJECTOR | **4**
Y28	EXHAUST GAS RECIRCULATION (EGR) SOLENOID
Y194	FUEL FLOW CONTROL VALVE
Y216	THROTTLE CONTROL SOLENOID
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

FORD FOCUS 2.0 DIESEL

Tracing and fixing faults in electronic engine management systems

The ubiquitous Ford Focus with diesel power has proved to be a popular and fuel-efficient vehicle. For this feature, **Kim Henson** and **Edward Haggar** take a close look at the third-generation Focus equipped with the 2.0-litre Duratorq engine.



Believe it or not the Ford Focus has been a part of the automotive scene for nearly 22 years. First-generation models, replacing the long-running Escort, were introduced in October 1998, and were highly acclaimed for their dynamic performance and comfort. The Focus became a best-seller in markets globally.

Second-generation Focus models (from 2005) built on these sound foundations, presenting to potential buyers fresh styling, a raft of new technologies, a stiffer body structure and excellent results in EuroNCAP safety tests.

In 2011 the third-generation Focus line-up was rolled out – notable features including new interior treatment, updated technologies and use of the new EcoBoost petrol engine.

For customers preferring diesel power, the Duratorq TDCi engines were offered in 1.6-litre or 2.0-litre versions. These common-rail, direct-injection motors incorporated twin-scroll turbochargers. They were the result of a joint venture with the PSA Group – and used in a wide range of models produced by Ford, Citroën, Peugeot and Volvo.

For this feature we are investigating a 163PS 2.0-litre Duratorq-powered Focus, dating from January 2014. Our guide to the diagnostic aspects of this Ford's diesel motor and its Delphi DCM 3.5 V4 management system is Edward Haggar.

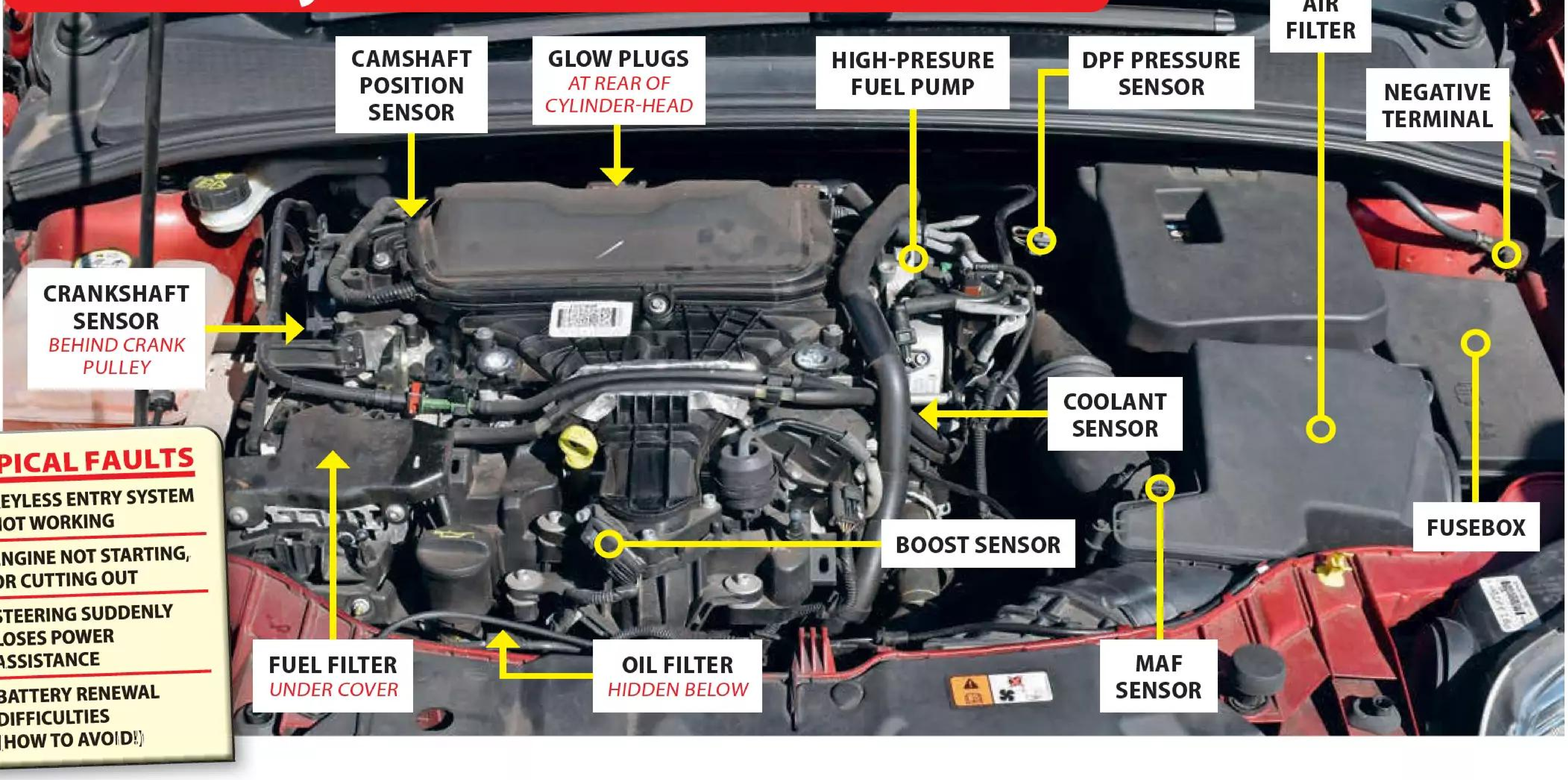
NOTE:
All references in our text and captions to 'left' and 'right' sides are from the point of view of someone sitting in the car and looking ahead.

Preparation

At the outset it is worth establishing whether the fuel injector identification label/sticker is still attached to the top of the engine. If so, make sure you take a photo of it or make a note of the code numbers for future reference – before it eventually becomes illegible or detached from the motor over time.

New fuel injectors will need to be coded to the engine, using a diagnostic tool such as the Snap-on SOLUS Edge or other dealer-level equipment.

1997cc 4-cylinder DOHC 16v turbodiesel



TYPICAL FAULTS

1. KEYLESS ENTRY SYSTEM NOT WORKING
2. ENGINE NOT STARTING, OR CUTTING OUT
3. STEERING SUDDENLY LOSES POWER ASSISTANCE
4. BATTERY RENEWAL DIFFICULTIES (HOW TO AVOID!)

Tool of choice

▶ The **Snap-on SOLUS Edge** diagnostic tool is perfect for use with this Focus, as well as many other makes and models.

Battery condition is very important on this Focus. When installing a replacement battery, it must be of the correct type as specified by Ford, and it requires programming to the vehicle using diagnostic equipment.

With this Ford it is still possible to carry out many basic diagnostic checks using a multimeter – for example assessing the charging rate, supply voltage, etc. – so in this regard the car is quite user-friendly for the DIY mechanic.

As said, the diesel engine set-up was used in other makes/models, and it's worth mentioning that from a diagnostic point of view – the equivalent Volvos (for example) feature many functions and programming options, largely as a result of the Ford connection.

As with virtually all modern diesel vehicles, while carrying out basic underbonnet checks it's worth checking the rubber pipework for signs of leaking, and security. It's amazing how much difference a tiny hole in a pipe/hose will make to running quality and economy.

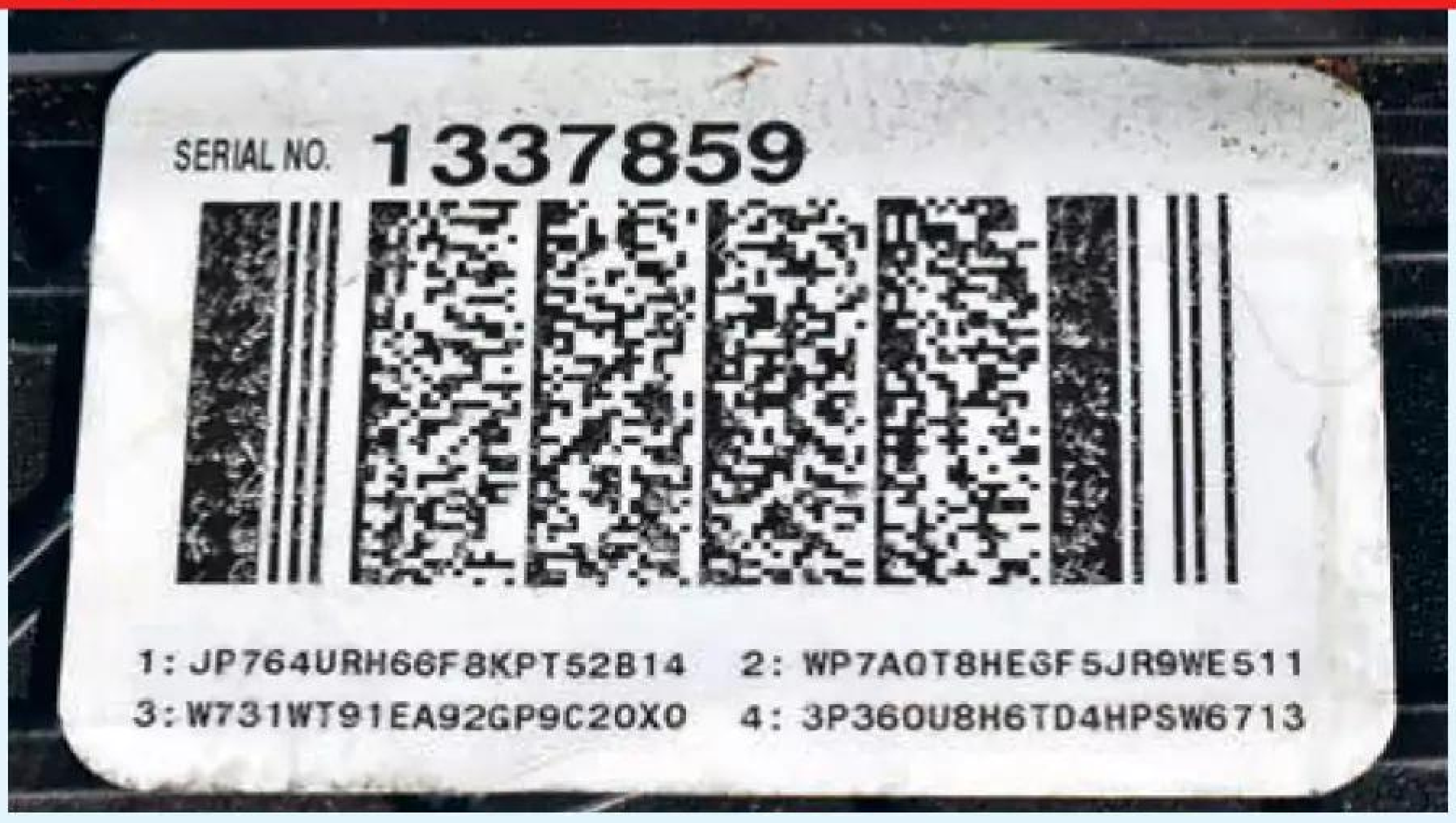
Regen DPF

Another feature of modern diesels, including this Focus model, is that periodically the Diesel Particulate Filter (DPF) needs to undergo 'regeneration' to rid it of accumulated debris, and to ensure efficient operation in terms of emissions and fuel consumption. On a vehicle that is used mainly on short runs in town, when the engine is seldom up to its optimum running temperature, the DPF can become choked much sooner than a car driven mainly on longer runs and at higher speeds, with the engine nearly always running at the ideal temperature.

The regen procedure is as follows:

1. Ensure that the engine is up to normal operating temperature.
2. Drive the car on a main road or motorway for at least 20 minutes, ensuring that the engine speed is between approx 1500 and 3000rpm.
3. The warning message and warning lamp extinguish when regeneration is completed.
4. Forced DPF regeneration can also be carried out using the manufacturer's or equivalent diagnostic equipment.

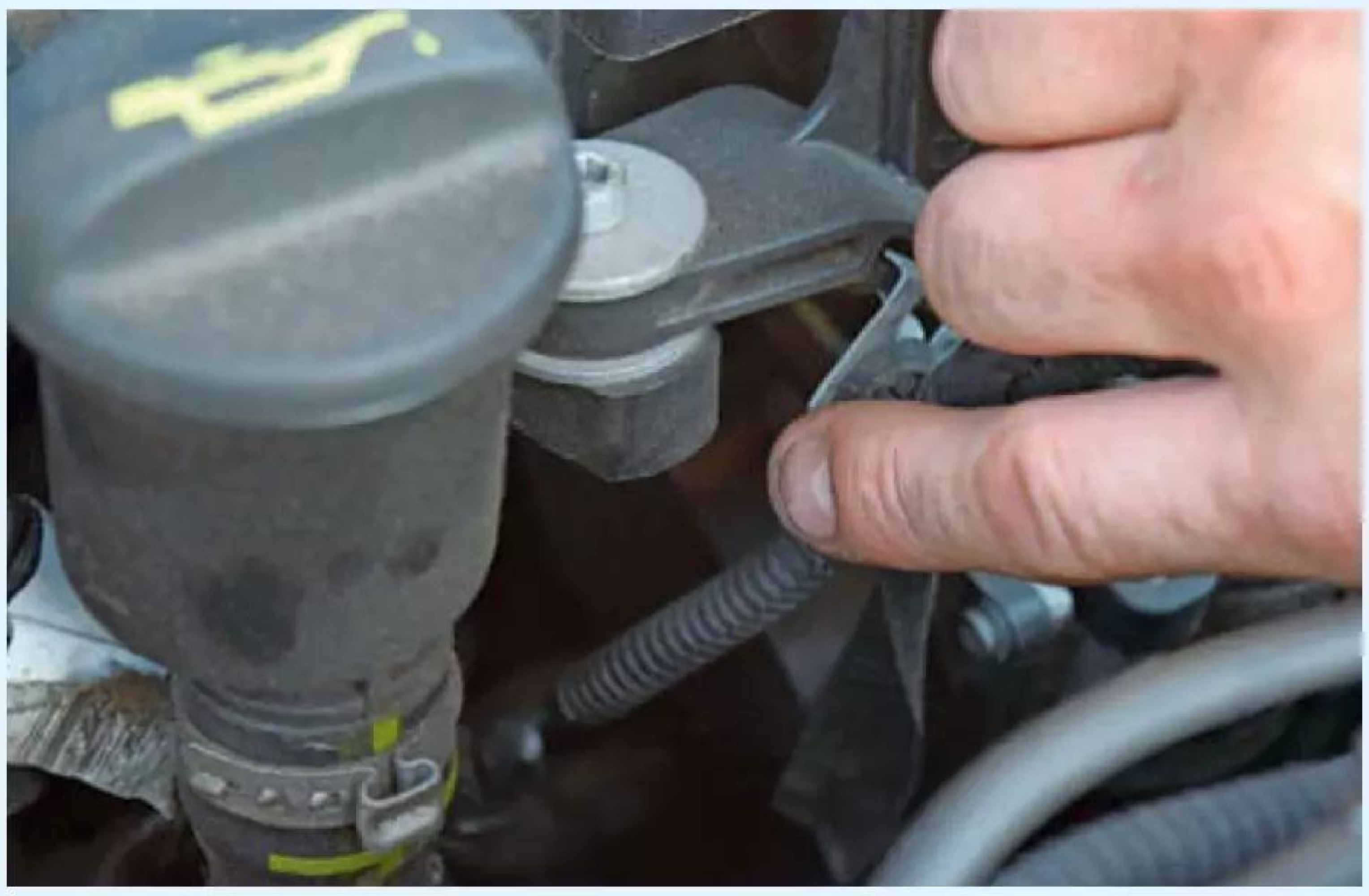
Typical Ford Focus components



1 ◀ **This label, at the top of the engine, identifies the original fuel injectors, so it is easy to tell whether the car has had replacements installed. If the sticker is still intact on your car, photograph it now or note the numbers, before it disappears!**

2 ▶ **The battery is easily accessible at the front left-hand corner of the engine bay. Check it for security, and also for the condition of its leads and connectors. The battery in this Focus MUST be as specified by Ford, and needs to be programmed to the car.**

PLATINUM
PRESTIGE



3 ◀ **The engine oil filter is deeply buried within the engine bay, and we could not get our camera close to it. However, in this shot Edward is indicating its location, close to the oil filler tube. Note that a special tool is required to remove the filter.**

4 **Stuffed in the crowded right-hand side of the engine bay is the fuel filter (below cover). It's vital that the filter is renewed at least as often as specified by Ford.**

ENGINE MANAGEMENT

The Delphi DCM 3.5 V4 management system used on this 2014 Focus incorporates these primary components:

- Multi-plug ECU.
- 4 x solenoid fuel injectors.
- Air mass sensor built into air filter trunking.
- ABS pump and ECU combined.
- AGM stop-start battery.
- Smart-charge alternator.
- Clutch and brake pedal position sensors.
- Manifold and intake pressure sensors.
- 4 x glow plugs.
- Engine coolant temperature sensor.
- Variable clutch air-conditioning compressor.
- Keyless-entry system.
- Throttle position sensor fitted to pedal and throttle body.
- Engine immobiliser built into dash console.
- DPF filter with pressure and temperature sensors.
- Crank and cam sensors.

Fault 1:

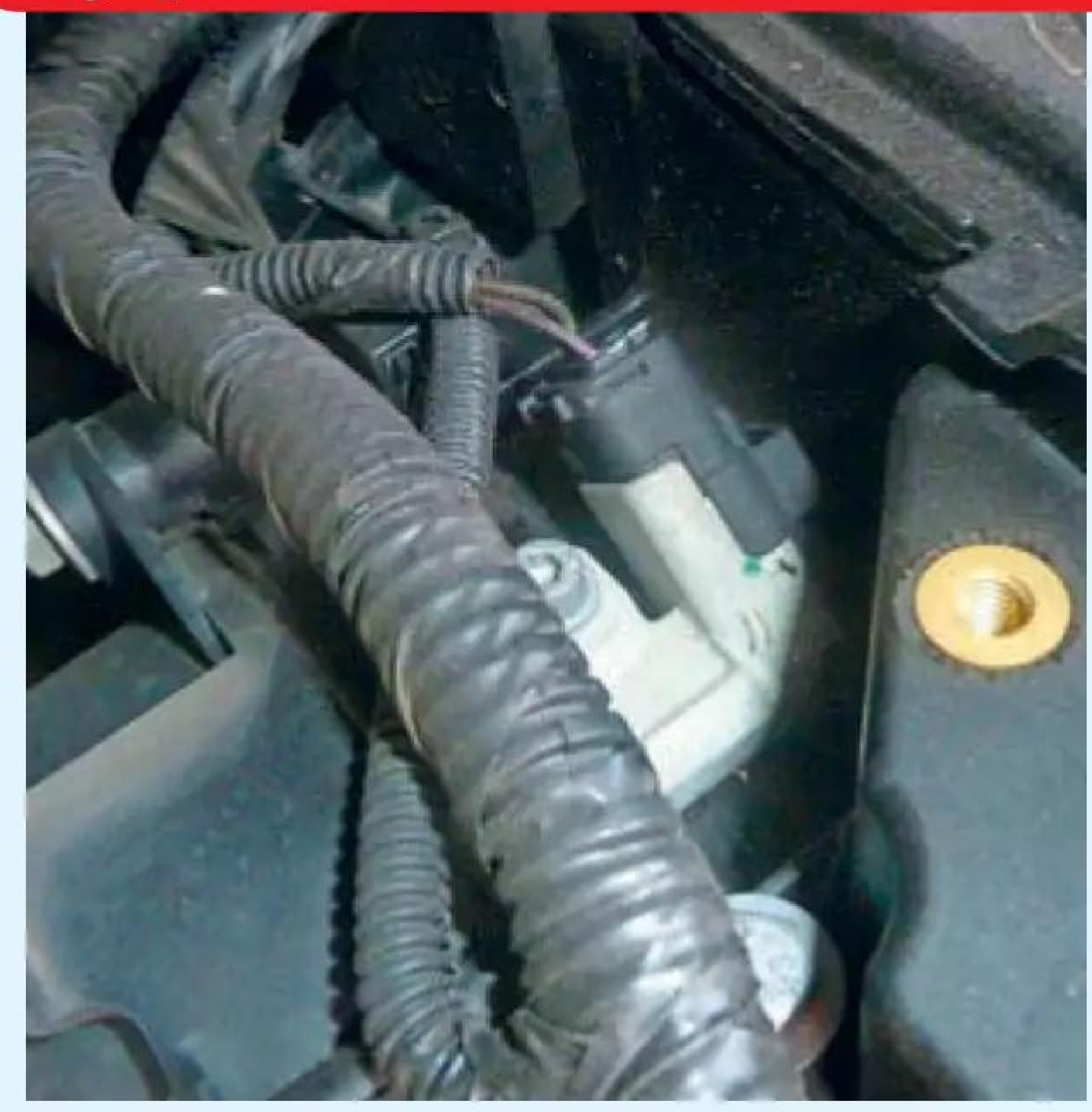
MOISTURE INGRESS INTO KEYLESS ENTRY SENSOR

When our first fault occurs, the keyless entry system will not operate, so when you approach the door, keys in hand, the car will not unlock as it should.

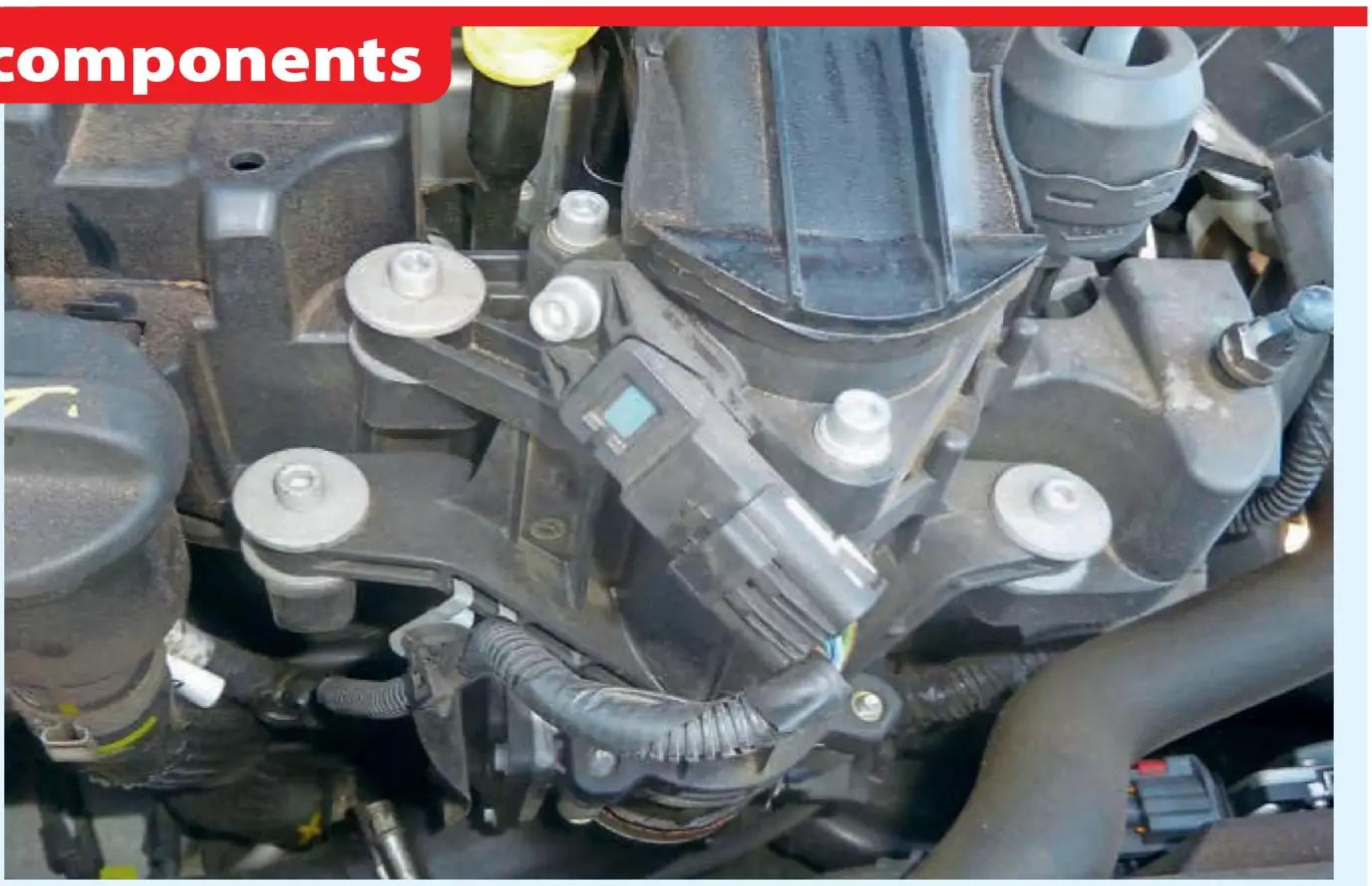
You might find that this fault will only become apparent in the winter or after rain. The problem lies with water entering the keyless entry sensor in the door handle.

Luckily rectification is a simple case of stripping the door down and applying a sealant (quality silicone) to keep water at bay, and re-assembling. It's worth saying though that if you experience this fault

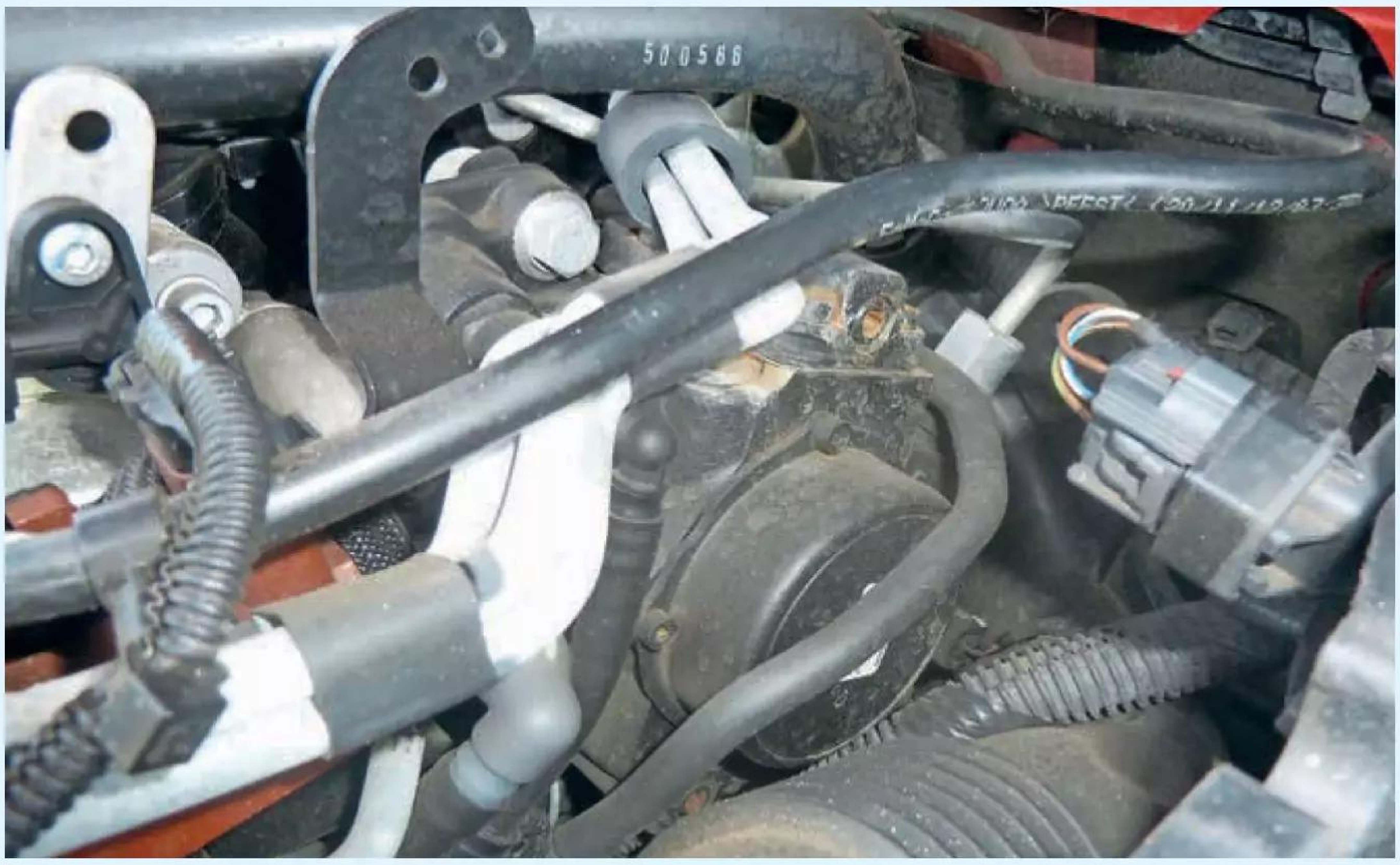
Typical Ford Focus components



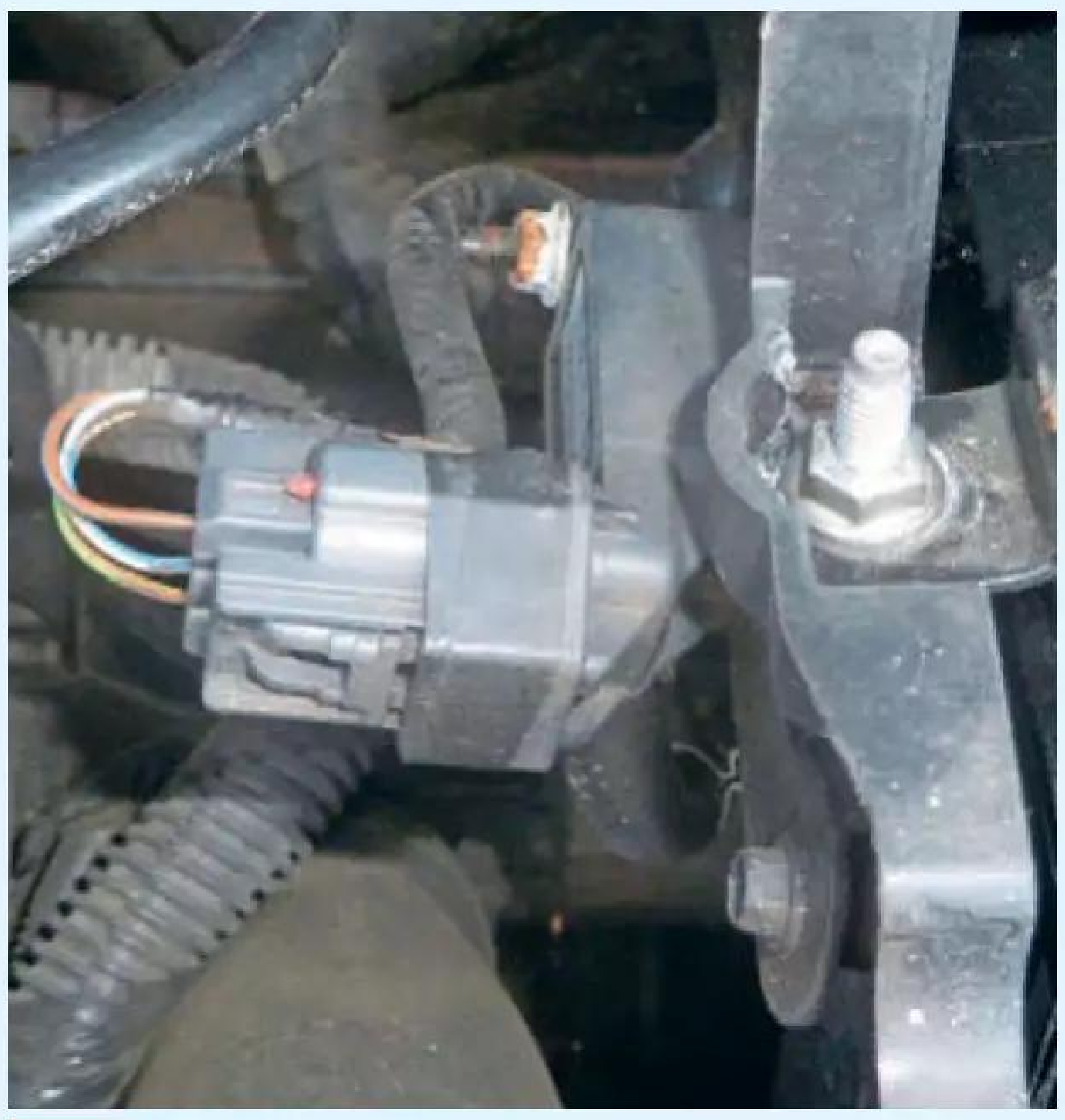
5 The camshaft position sensor (on the right-hand side, at the rear of the cylinderhead), acts to provide the ECU with information regarding precise camshaft position, so that the appropriate engine ignition and fuel injection timing settings can be applied by the ECU.



6 Shown here is the intake/inlet manifold pressure sensor and its housing, located at the front of the engine compartment and highly accessible. The sensor monitors the pressure within the intake tract, sending this data to the ECU to help determine fuelling levels.



7 The high-pressure fuel pump is mounted on the cylinder-head, and is found on the left-hand side of the engine bay, towards the rear. The pump is gear-driven from the camshaft.



8 The Diesel Particulate Filter (DPF) pressure sensor (seen here on the left side of engine bay) is to keep track of the pressure differential levels before and after the DPF. This measurement enables the ECU to calculate when 'regeneration' is required to cleanse the DPF.

you must deal with it quickly to ensure that corrosion doesn't fully set in.

In diagnostic terms, if required you could look at 'body control' via live data and see if an open signal is requested – but generally you will find that the fault lies within the door handle sensor.

Fault 2:

CRANKSHAFT POSITION SENSOR FAILURE

When this fault occurs, the engine may refuse to start, or cutting-out may occur. Likely fault codes could be any of the following: P167 fuel timing error, P1309 misfire monitor-malfunction, P130F crankshaft position CKP sensor, P1336 crankshaft position circuit range.

The fault lies with the crank position sensor that's located on the crankshaft gear behind the pulley.

Edward advises that testing can be carried out in a few different ways, but his preferred method is to connect the diagnostic tool of choice and load engine live data for rpm signals. If the sensor has failed, you won't get a signal.

You could just go for the crank sensor if you are fairly sure, or if you wanted to get deeper into checking, you need to test for supply voltage at the sensor and a signal. Replacement of the sensor involves removing the crankshaft pulley that's secured with a bolt (22mm spanner) but Edward has known these to be very tight and has even seen them snap before. He finds that if the bolt doesn't move easily using an air gun, his next step is to remove the starter motor and fit a flywheel locking tool. As always the advice is to fit a high-quality sensor.

Technical Specs

Actual values

Component	Value
Glow plug	0.2 ohms
Injector	1.5 ohms
Crankshaft sensor	0-5 volts switching
Fuel rail pressure sensor, idling	1.1 volts
Coolant sensor: 25°C 81°C	 5100 ohms 641 ohms
Crankshaft pulley torque (with new bolt)	70Nm + 60°

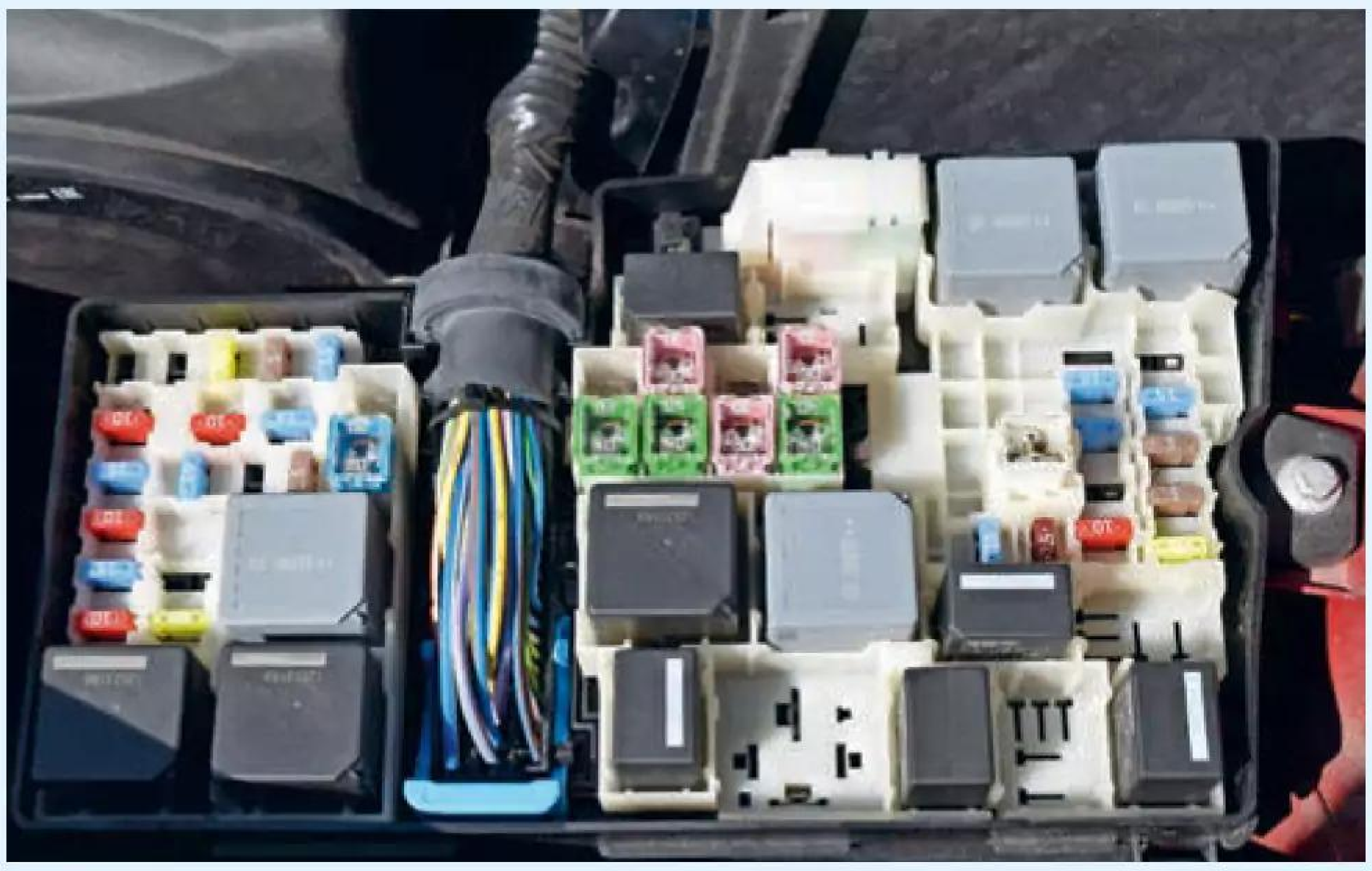
Fault 3:

FAILED POWER STEERING MOTOR

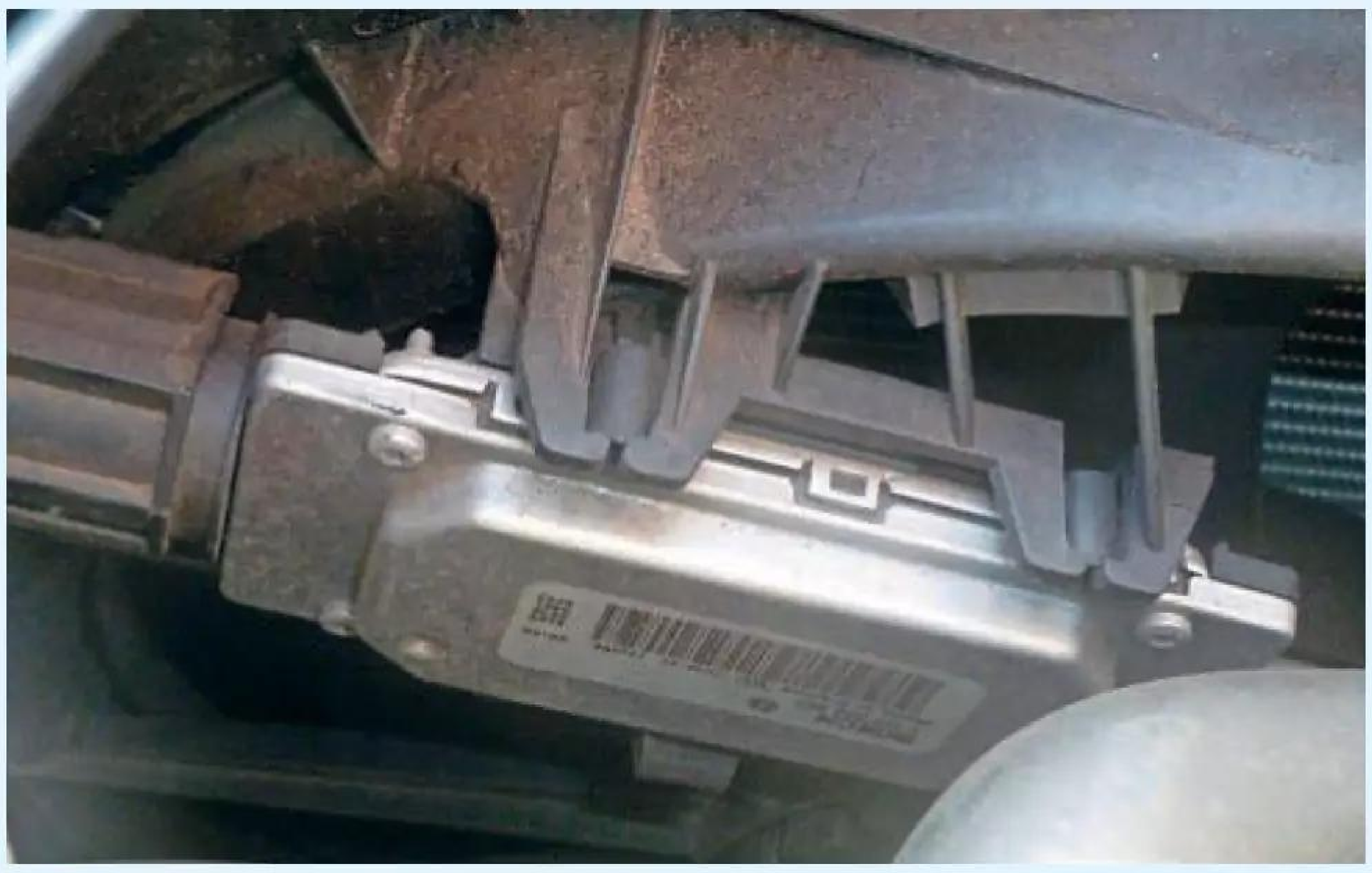
If this fault occurs, the symptoms are scary, because the problem arises completely out the blue with no prior warning. You lose all the assistance from the power steering, and these days driving a car without power steering comes as a shock and the car will be very heavy to turn.

The key to pinpointing this fault is that when you carry out a diagnostic check the fault code 'U3000 internal failure' will show up and won't clear.

The fault lies with the power steering motor which has failed. The unit is on

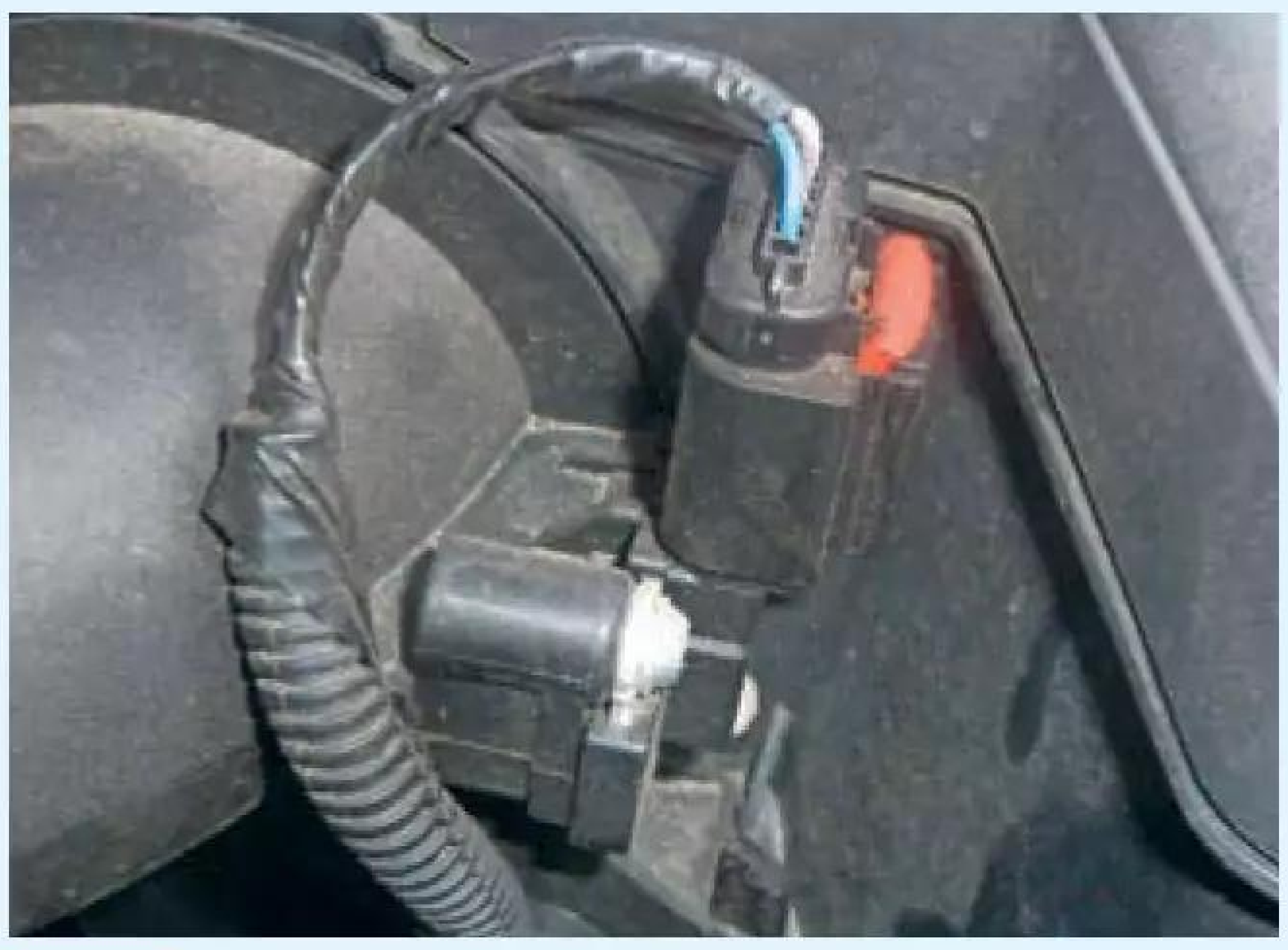


9 The underbonnet fuse and relay box is positioned on the left-hand side of the engine compartment. Ensure that the lid fully seals over the top of the unit, and is correctly fitted, because moisture ingress will result in serious operational issues!

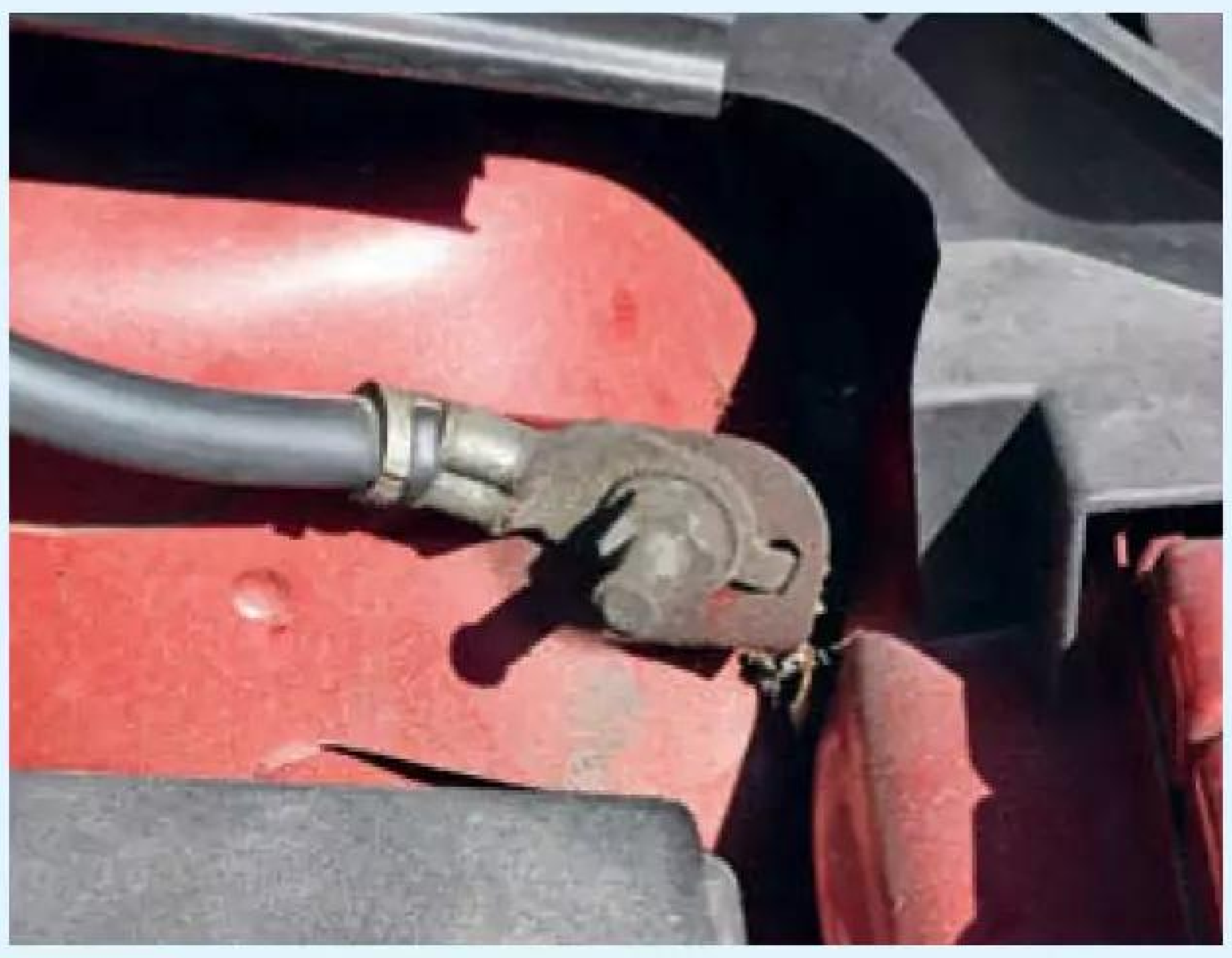


10 Close to the front of the vehicle is the cooling fan's control unit/ECU. Check the condition and security of the unit itself, also its cables and electrical connections. Any water ingress here could result in the fans running continuously and not shutting off.

11 Here, Edward is pointing out the throttle body assembly, which is positioned towards the front of the engine bay, on the right-hand side. Cleaning can be carefully undertaken, using a gentle cleaning agent and a soft brush.



12 The Mass Air Flow sensor (MAF) is housed within the intake/inlet trunking, where it monitors the rate of flow of air through the intake/inlet system. On receipt of this information, the ECU can determine the appropriate fuelling levels for any given situation.



13 On the left-hand front suspension turret is this vital earth/ground connection, which doubles as a 'jump start' connector point. If you have to jump start the vehicle, always use this, rather than connecting directly to the battery. Check for security and cleanliness.

⇨

the steering rack. It is necessary to lower the subframe and remove the rack in order to gain access to the motor. Edward says that he always sends his units away for repair as opposed to replacement, due to the cost.

Fault 4:

DEFECTIVE BATTERY (RENEWAL)

This advice is more in the form of a precaution than a specific fault, when it becomes necessary to renew the battery.

Due to its buried location, after being disconnected the battery must be extricated at an angle. Alternatively you can remove the air filter housing to provide more room, after carefully lifting free the plastic cover.

Remember that this car requires an Absorbent Glass Mat (AGM) battery due to the vehicle's Stop-Start system.

USEFUL DATA

Below are shown the official recommended change intervals for the various components of the Ford Focus Mk3 2.0 TDCi. However, Edward strongly advises that these service/change intervals should be at least halved.

Service intervals:
Officially every 12,500 miles or 12 months, whichever comes first.

Engine oil: 12,500 miles or 12 months, whichever comes first. Note that the oil filter is not easy to reach, and its removal requires a special tool.

Oil Type: SAE 5W-30 OEM WSS-M2C913-C fully-synthetic.

Capacity ('service' fill): 5.7 litres.

Sump plug torque setting: 34Nm.

Oil filter torque setting: 25Nm.

Brake fluid: Every 24 months.

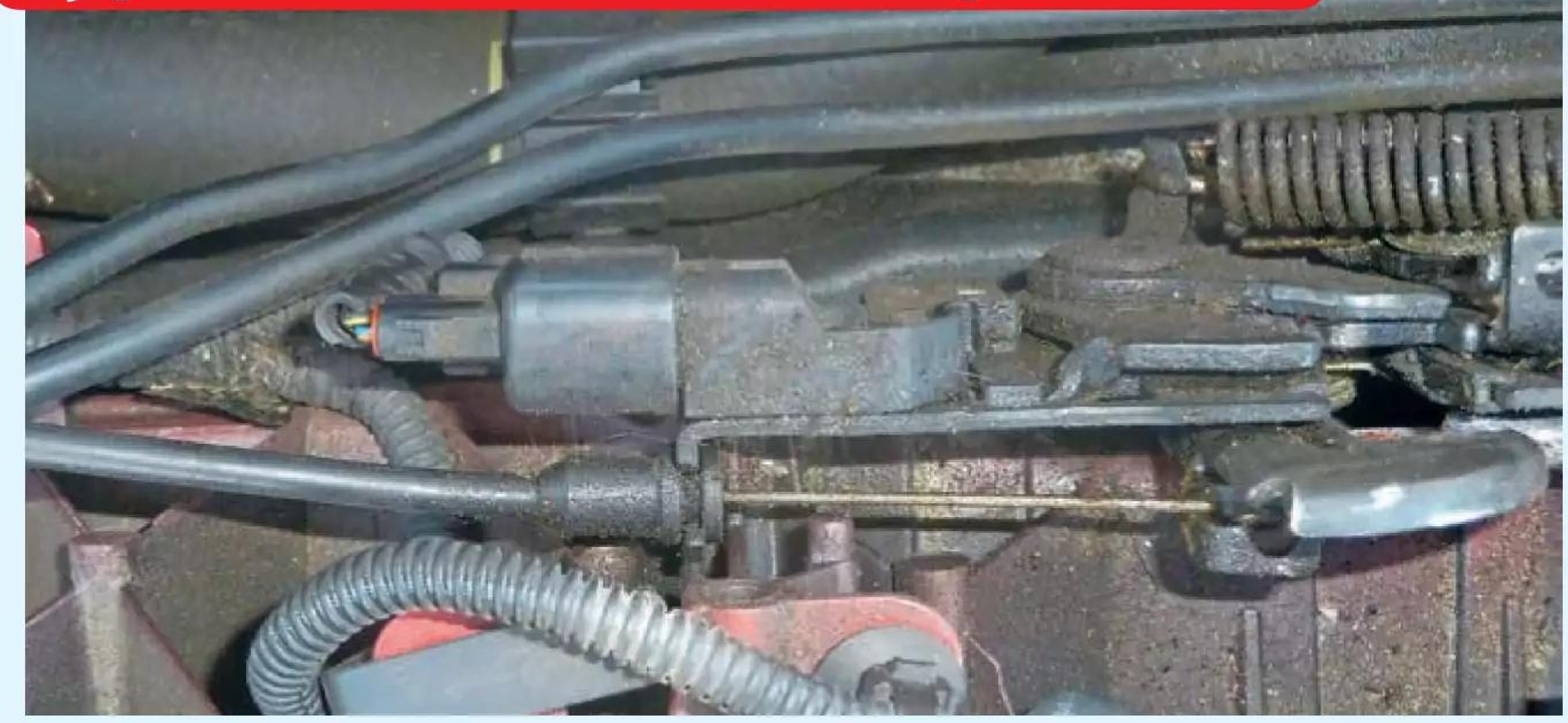
Diesel fuel and air filters: Officially renew every 37,500 miles or 36 months.

Cambelt: Renew at least every 125,000 miles or 120 months.

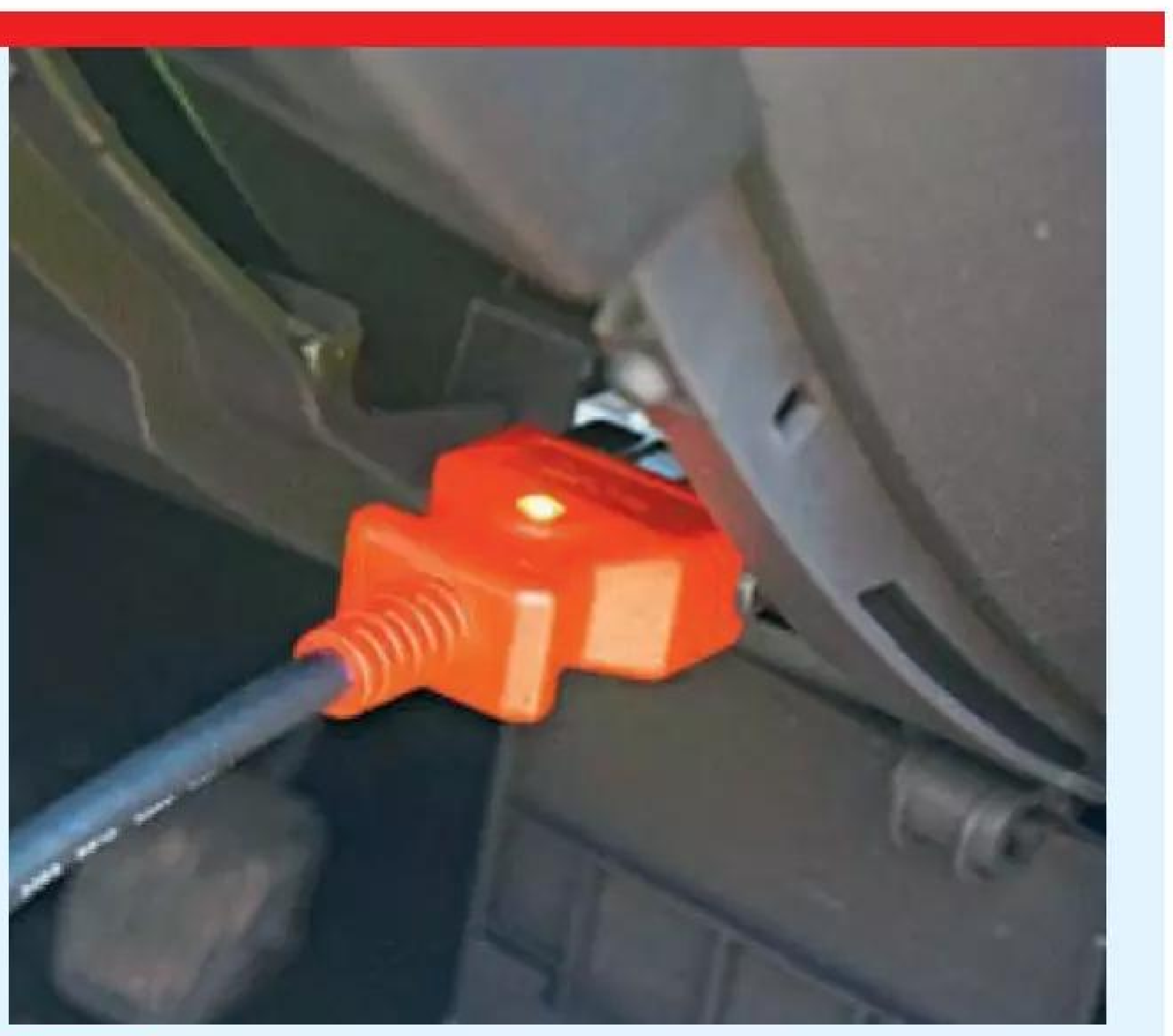
After installing and connecting the new battery, proceed as follows:

1. Start engine.
2. Allow engine to idle for three minutes.
3. Ensure that engine is at operating temperature.
4. Increase and maintain engine speed at 1200rpm for approximately two minutes.
5. Drive the vehicle for at least five miles (8km).

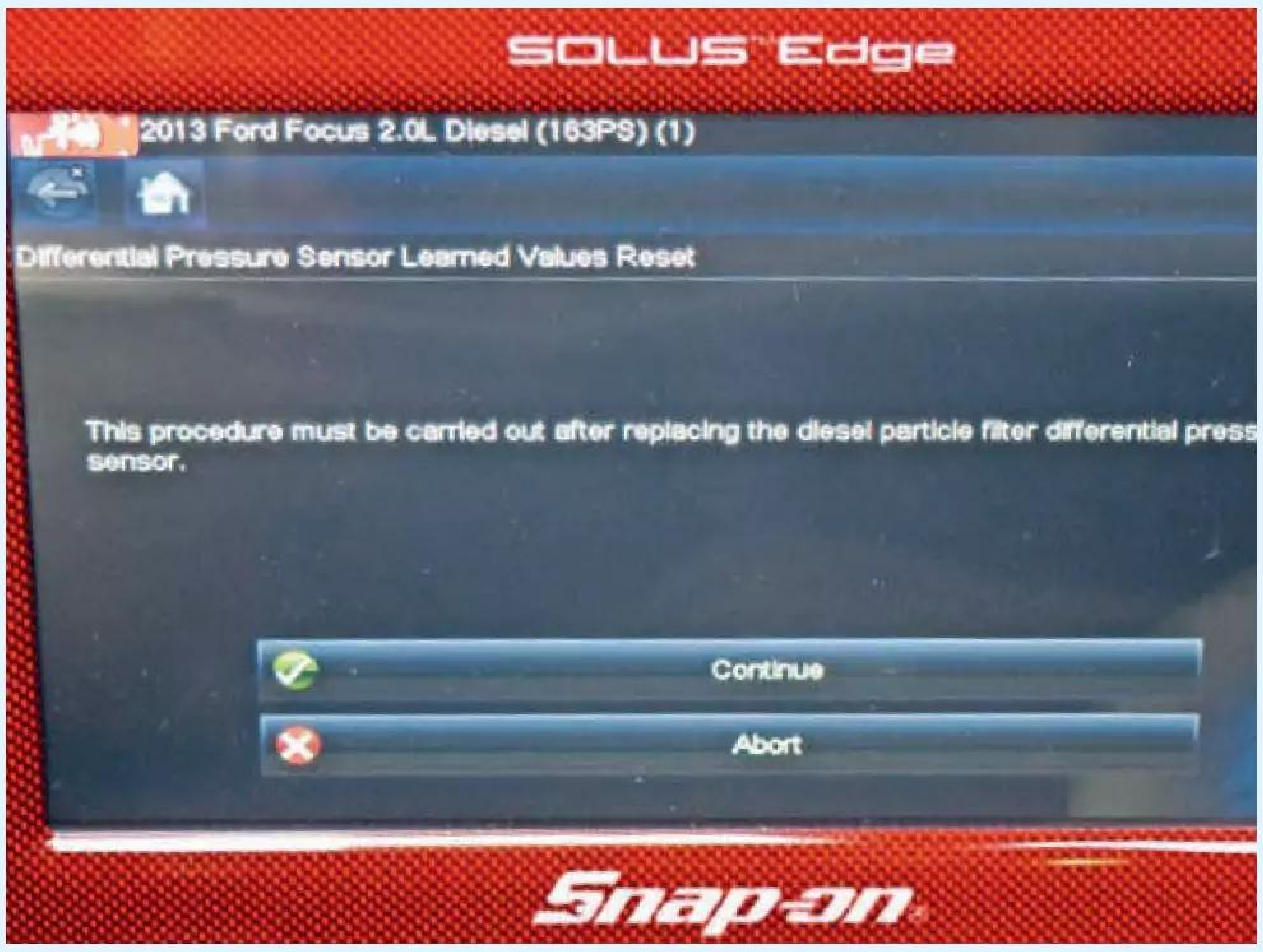
Typical Ford Focus components



14 **Seen from above, the bonnet position switch assembly, located right at the front of the engine bay, must function correctly or the engine won't start. Check condition, security and electrical connections. Ensure too that the mechanism is adequately lubricated.**



15 **The diagnostic socket on this Focus Mk3 is mounted on the right-hand side, at the lower edge of the fascia. When not in use it is out of sight behind a plastic cover panel. As you can see here, the connector plug/wiring from the SOLUS Edge tool is connected.**

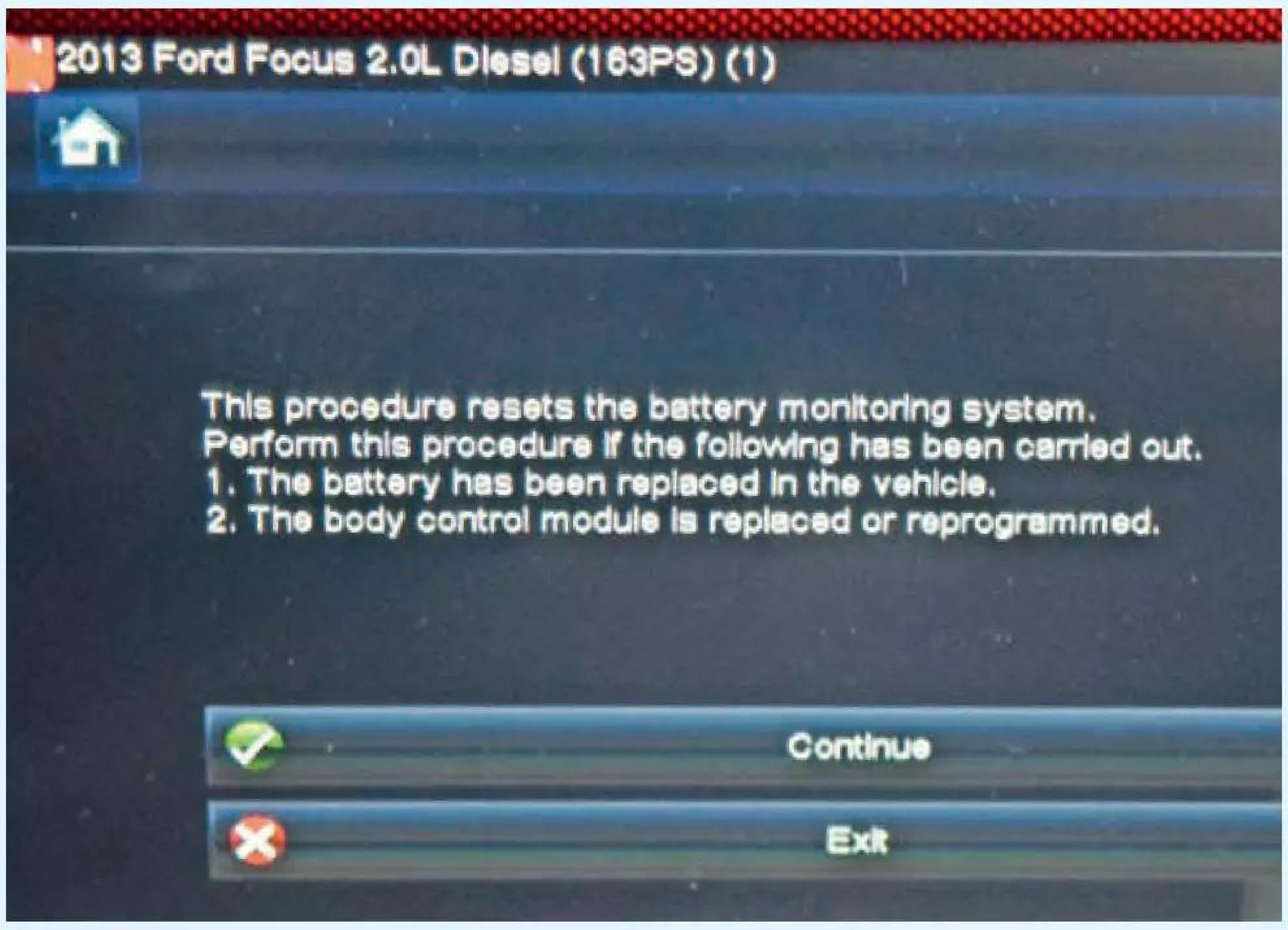


2013 Ford Focus 2.0L Diesel (163PS) (1)

Differential Pressure Sensor Learned Values Reset

This procedure must be carried out after replacing the diesel particle filter differential press sensor.

16 **This screen shot on the SOLUS Edge is displayed during re-setting operations for the DPF pressure sensor. Note that when this sensor is renewed, re-setting is required.**



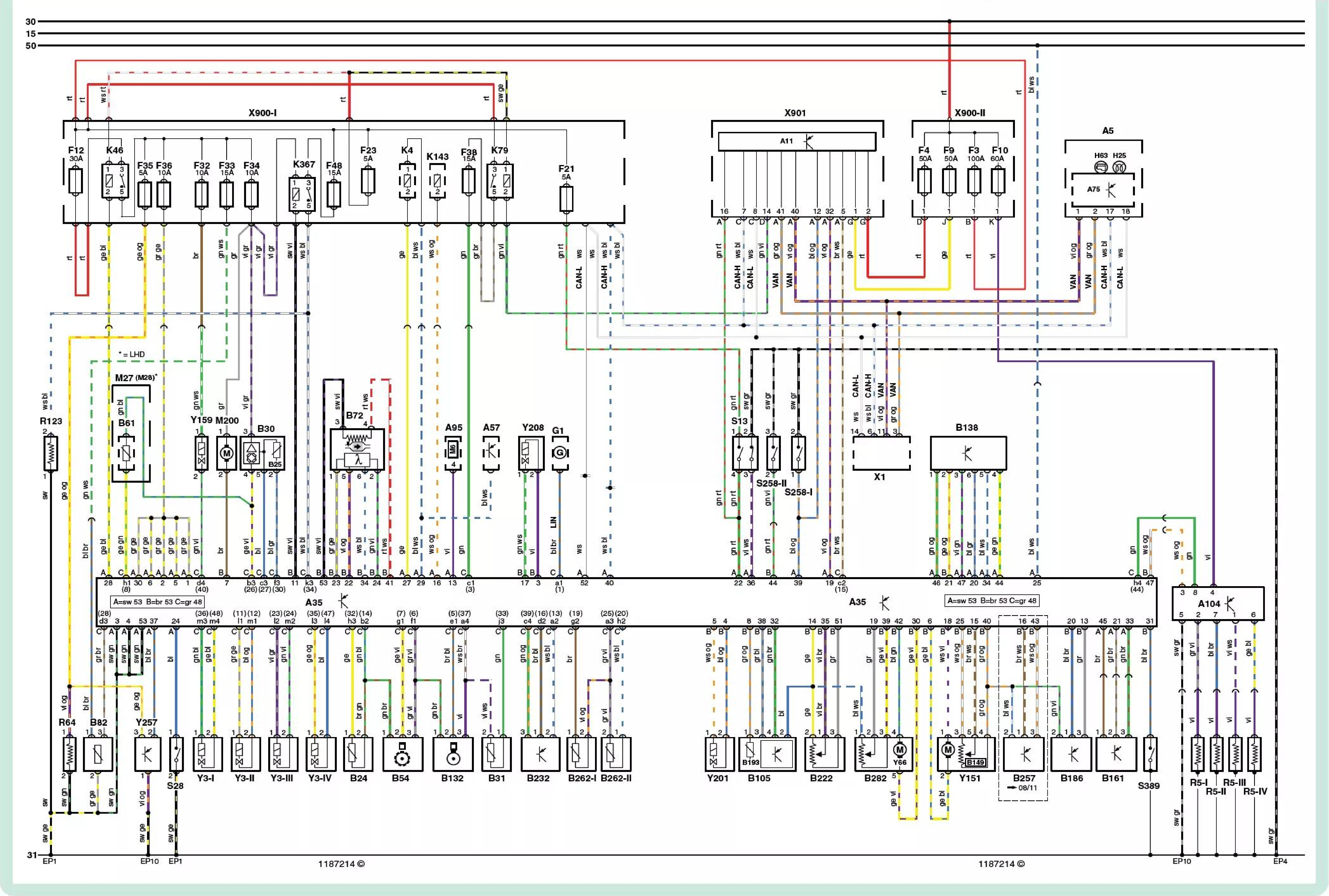
2013 Ford Focus 2.0L Diesel (163PS) (1)

This procedure resets the battery monitoring system.
Perform this procedure if the following has been carried out.
1. The battery has been replaced in the vehicle.
2. The body control module is replaced or reprogrammed.

17 **This 'battery reset' screen shot on the SOLUS Edge diagnostic tool is the one through which a new battery is programmed to the vehicle. It's essential always to ensure that the new battery is of the type specified by Ford.**

Autodata
www.autodata-group.com

DELPHI DCM 3.5 V4 CIRCUIT DIAGRAM


30
15
50
X900-I
X901
X900-II
A5
A11
F12 30A
K46
F35 5A
F36 10A
F32 10A
F33 15A
F34 10A
K367
F48 15A
F23 5A
K4
K143
F38 15A
K79
F21 5A
F4 50A
F9 50A
F3 100A
F10 60A
H63
H25
A75
CAN-L
CAN-H
VAN
LIN
* = LHD
M27 (M28)*
R123
B61
Y159
M200
B30
B25
B72
A95
M6
A57
Y208
G1
S13
S258-II
S258-I
X1
B138
A35
A104
R64
B82
Y257
S28
Y3-I
Y3-II
Y3-III
Y3-IV
B24
B54
B132
B31
B232
B262-I
B262-II
Y201
B193
B105
B222
B282
Y66
Y151
B149
B257
08/11
B186
B161
S389
R5-I
R5-II
R5-III
R5-IV
31
EP1
EP10
EP4
1187214 ©

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A104	GLOW PLUG CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B61	OUTSIDE AIR TEMPERATURE SENSOR
B72	HEATED OXYGEN SENSOR (HO2S)
B82	FUEL/WATER SEPARATOR SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B149	EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B193	TURBOCHARGER/SUPERCHARGER (TC/SC) BOOST AIR TEMPERATURE SENSOR
B222	TURBOCHARGER (TC) VANE POSITION SENSOR
B232	DIESEL PARTICULATE FILTER (DPF) PRESSURE SENSOR
B257	EXHAUST GAS RECIRCULATION (EGR) COOLER BYPASS FLAP POSITION SENSOR
B262-I	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR | 1
B262-II	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR | 2
B282	INTAKE AIR FLAP CONTROL ACTUATOR POSITION SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
EP	EARTH POINT
F	FUSE
G1	ALTERNATOR
H25	GLOW PLUG WARNING LAMP
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K4	STARTER MOTOR RELAY
K46	ENGINE CONTROL (EC) RELAY
K79	IGNITION MAIN CIRCUITS RELAY
K143	AC COMPRESSOR CLUTCH RELAY
K367	DIESEL PARTICULATE FILTER (DPF) REGENERATION GLOW PLUG RELAY
LIN	LOCAL INTERCONNECT NETWORK (DATA BUS)
M6	ENGINE COOLANT BLOWER MOTOR
M27	DOOR MIRROR ADJUSTMENT MOTOR, DRIVER
M200	DIESEL PARTICULATE FILTER (DPF) REGENERATION FUEL PUMP
R5-I	GLOW PLUG | 1
R5-II	GLOW PLUG | 2
R5-III	GLOW PLUG | 3
R5-IV	GLOW PLUG | 4
R64	FUEL FILTER HEATER
R123	DIESEL PARTICULATE FILTER (DPF) REGENERATION GLOW PLUG
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S28	REVERSE GEAR POSITION SWITCH
S258-I	CLUTCH PEDAL POSITION (CPP) SWITCH | 1
S258-II	CLUTCH PEDAL POSITION (CPP) SWITCH | 2
S389	ENGINE OIL PRESSURE SWITCH
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | 1
X900-II	FUSEBOX/RELAY PLATE, ENGINE BAY | 2
X901	FUSEBOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y66	INTAKE AIR FLAP CONTROL ACTUATOR
Y151	EXHAUST GAS RECIRCULATION (EGR) VALVE ACTUATOR
Y159	FUEL QUANTITY ADJUSTER
Y201	TURBOCHARGER (TC) VACUUM RESERVOIR SOLENOID VALVE
Y208	EXHAUST GAS RECIRCULATION (EGR) COOLER BYPASS VALVE
Y257	ENGINE COOLANT RADIATOR SHUTTER ACTUATOR
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -
50	IGNITION SWITCH - START SIGNAL

Electronic Diagnostics

VOLVO V40 2.0 DIESEL

Tracing and fixing faults in electronic engine management systems

Volvo's V40 can make an effective used buy, and frugal too with the company's own five-cylinder 2.0-litre diesel. **Kim Henson** and **Edward Haggar** lift the diagnostic lid on a 2013 example.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

The first V40 five-door estate car (derived from the S40 saloon) was the result of a joint project between Volvo and Mitsubishi, and was produced from 1995 until 2004. Second-generation S40 saloons (incorporating many aspects of contemporary Ford Focus and Mazda3 models) spanned the years 2004 to 2012, however from 2004 the V40 estate disappeared in favour of a new V50 estate during those years.

However, the V40 model name came back from 2013 (until 2019), and the new car was hailed for its practicality and build quality. Engine options included a wide variety of petrol and diesel units, including Volvo's own 2.0-litre five-cylinder turbodiesel. Engine apart, much of the model was related to Ford's Focus, but the Volvo was considered more upmarket.

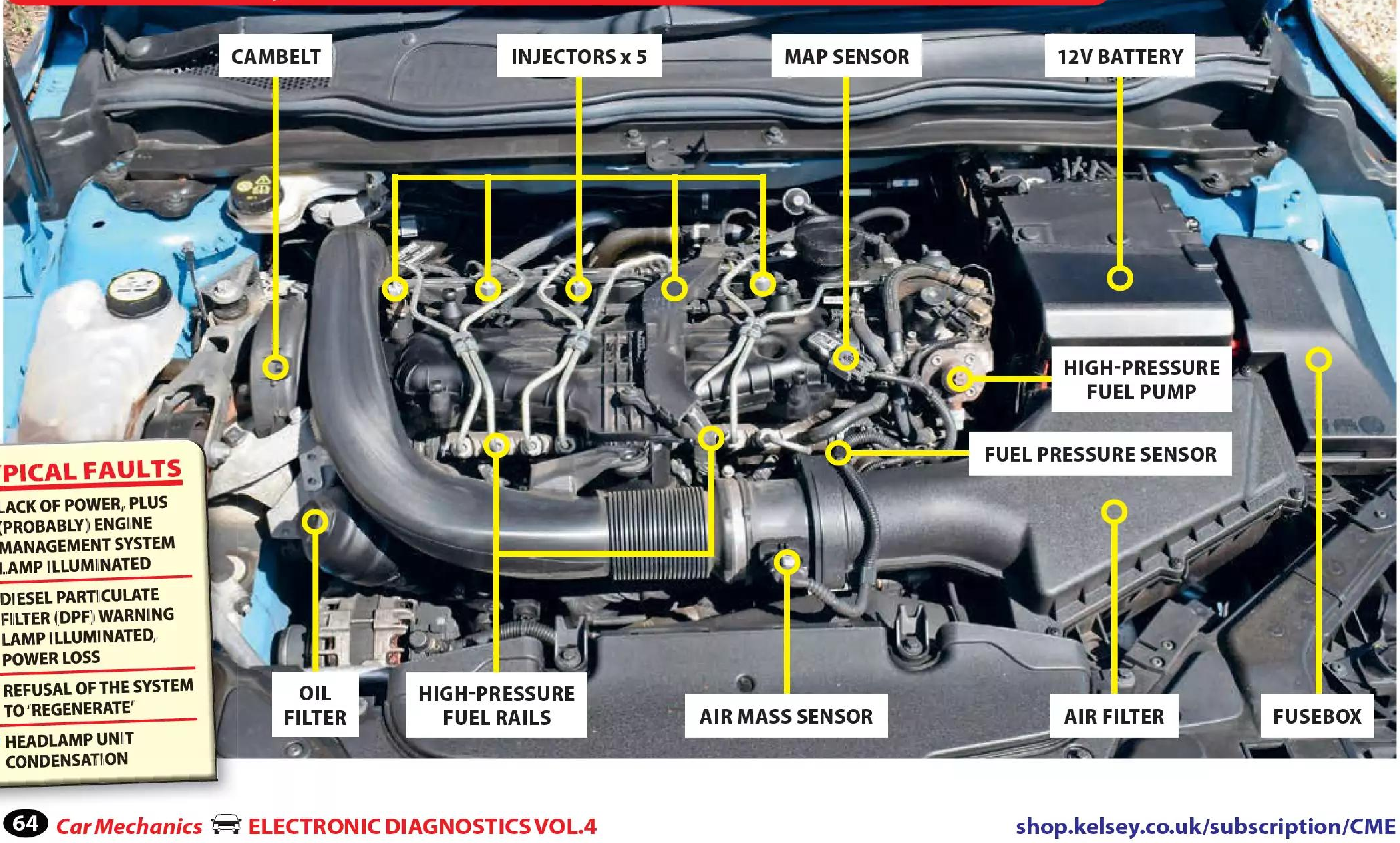
This month we are looking at a 2013 example equipped with this five-cylinder engine. In fact, the car we photographed is an 'R-Design' version, with many standard-fit enhancements, but in terms of diagnostics the approach is similar for all variants. Our diagnostic guide to this Volvo is Edward Haggar.

Preparation

In many respects this Volvo model is quite easy to work on for the do-it-yourself mechanic, and there are no fears when it comes to servicing aspects at least.

It is important to appreciate that the engine oil level as indicated by the dipstick should be approximately two-thirds of the way up between the 'minimum' and 'maximum' level markers. This is to allow for an increase in the oil level, caused by

1984cc 5-cylinder 20v turbodiesel Geartronic



TYPICAL FAULTS

① LACK OF POWER, PLUS (PROBABLY) ENGINE MANAGEMENT SYSTEM LAMP ILLUMINATED

② DIESEL PARTICULATE FILTER (DPF) WARNING LAMP ILLUMINATED, POWER LOSS

③ REFUSAL OF THE SYSTEM TO 'REGENERATE'

④ HEADLAMP UNIT CONDENSATION

Tool of choice

▶ The **LAUNCH X431 EURO TAB II** diagnostic tool is perfect for use with this V40, as well as many other makes and models.

the regeneration process (and the deposits of soot that are displaced by it). If the oil level starts off at the 'maximum' level, the regeneration process will cause the level to rise, triggering illumination of the warning lamp showing that the engine has been over-filled with oil.

A critical aspect of keeping this diesel-powered V40 on top form is to ensure that the Diesel Particulate Filter (DPF) is unobstructed. If the 'DPF' symbol illuminates on the dash, it is telling the driver that regeneration is required. If this happens when the car is being driven, it's important NOT to switch off the engine before regeneration has been actioned, or the DPF system will shut down and the filter will become further clogged.

If the vehicle does not 'self-regenerate', a forced regeneration needs to take place. Proceed as follows:

1. Ensure that the engine is at optimum running temperature.
2. Drive for 20 minutes on a main road or motorway (at a reasonably high but legal and safe speed).
3. Watch for the 'DPF' symbol on the dash to extinguish, indicating that regeneration has been successfully completed. If the symbol doesn't extinguish, further attention is required.

Fault 1:

EGR VALVE ACTUATOR FAILURE

When this problem occurs, it is likely that the engine management warning lamp will be illuminated. Also, depending on the position in which the actuator has failed, a lack of power will almost certainly also be evident.

Carrying out a diagnostic check may reveal a wide variety of possible fault

Typical Volvo V40 components

1 ◀ **In order to gain access to the top of the engine, it is first necessary to remove the large plastic cover panel, which incorporates two separate clip-on sections, one of which is shown in this photograph. Work with care; don't force the plastic or it may fracture!**

2 ▶ **This V40 is equipped with a fuel and emissions-saving stop-start system, and the battery MUST be the correct specified type in order to cope, and to work effectively. Adequate electrical power is essential; check all cables and connections too.**

3 ◀ **The battery's negative (earth or ground) terminal incorporates a monitor forming part of the 'smart charge' system which is fitted to this Volvo to help save fuel and emissions. Check for condition and signs of corrosion; during servicing clean and lightly grease the terminals.**

4 ▶ **The alternator is located on the right-hand side of the engine bay. Its condition and operational effectiveness is key to correct functioning of the 'smart charge' (sometimes termed 'intelligent') charging set-up. The ECU controls alternator output at all times.**

⇨

codes (too many to list here in totality). Here are some examples of the codes that may appear:

P0403 'Exhaust gas recirculation (EGR) circuit malfunction', with possible causes of the trouble including the wiring, the EGR (Exhaust Gas Recirculation) solenoid and the ECM (Engine Control Module).

P042E 'EGR valve actuator – stuck open', possible culprits being the wiring, EGR valve actuator, the ECM or a mechanical problem.

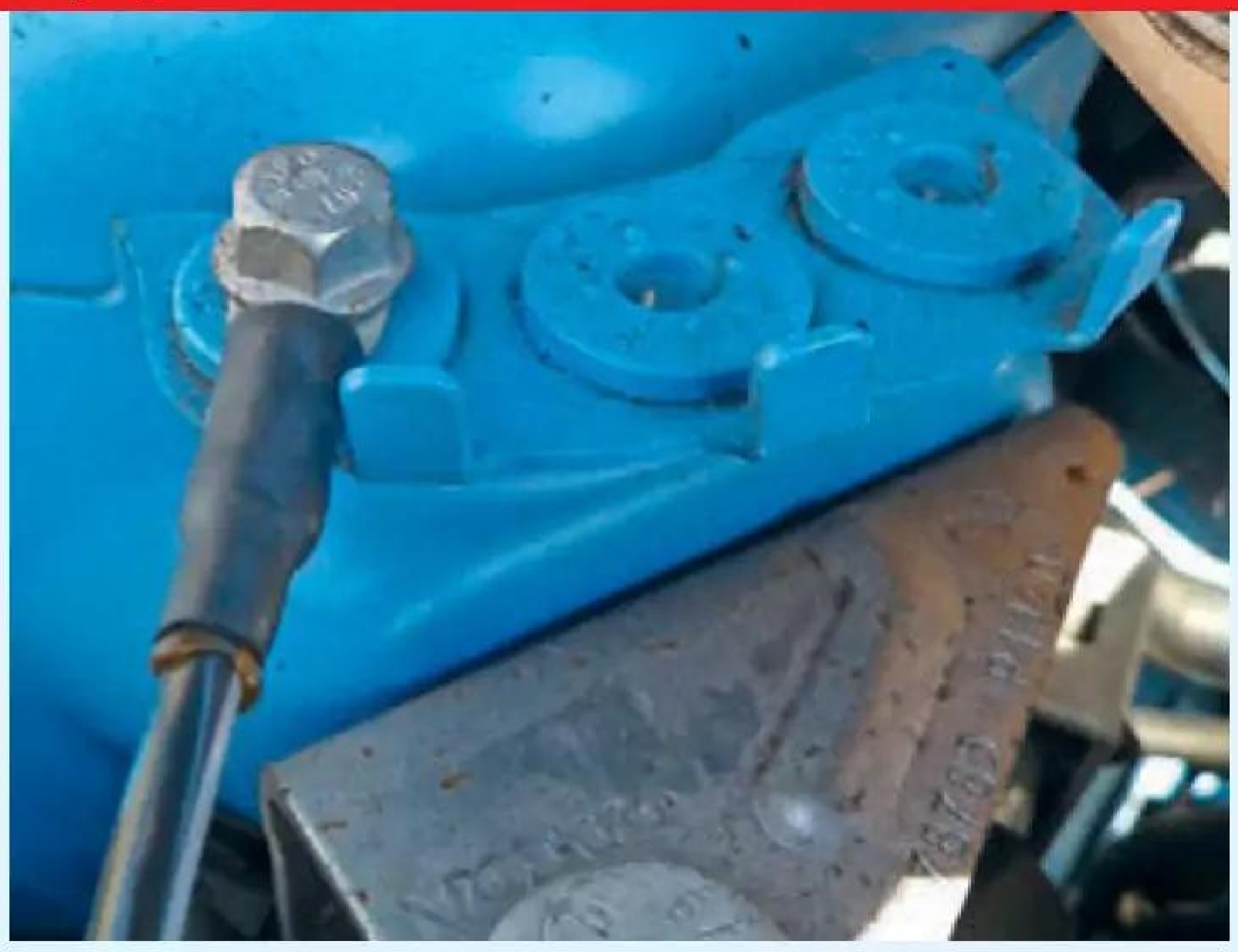
P042F 'EGR valve actuator – stuck closed', possible culprits being the wiring, EGR valve actuator, the ECM or a mechanical problem.

ENGINE MANAGEMENT

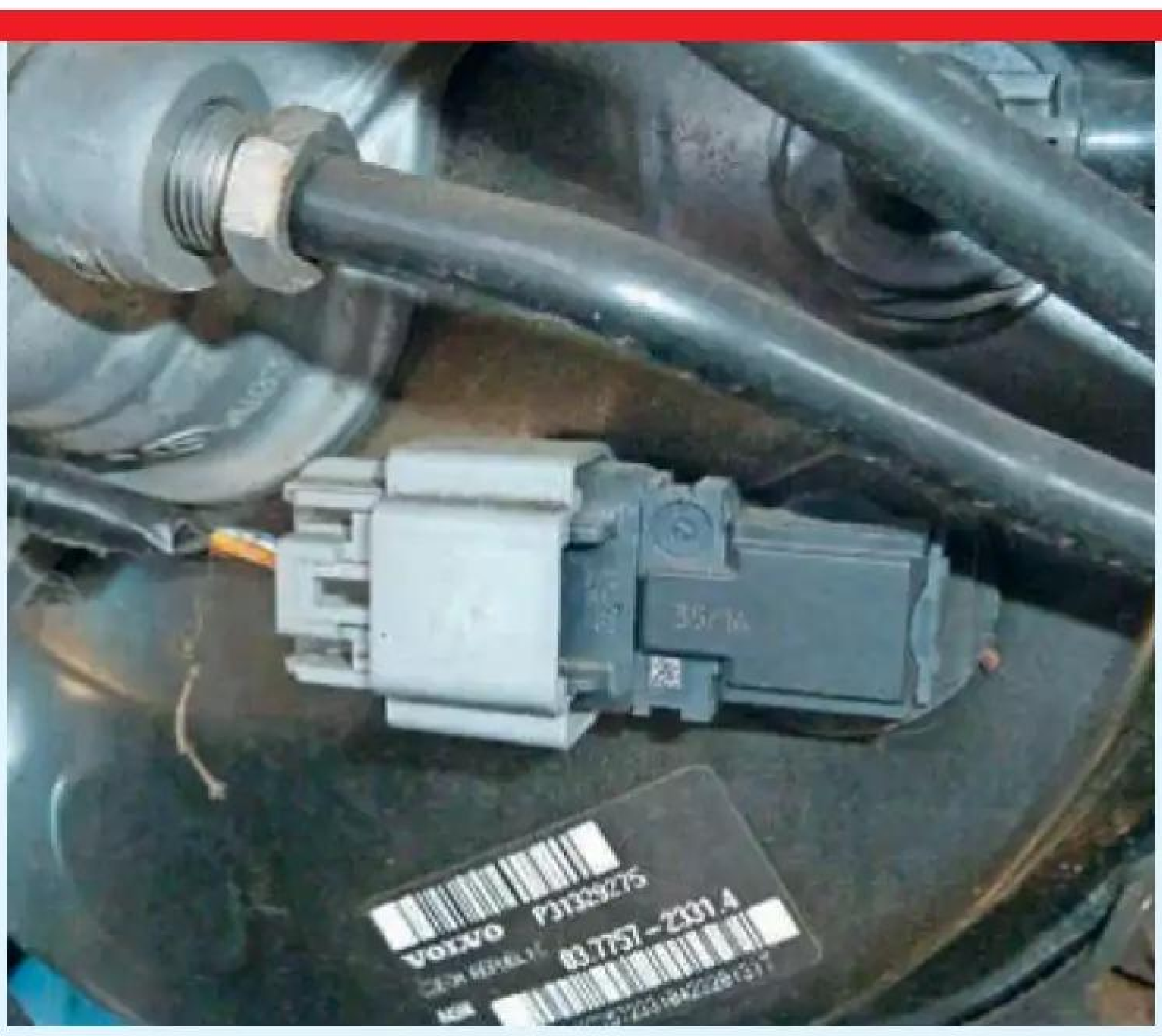
The management system used on this V40 incorporates these primary components:

- Multi-plug ECU.
- 4 x piezo type fuel injectors.
- Air mass sensor, within the air filter trunking.
- Absorbent glass mat (AGM) 'stop-start' type battery.
- Smart charge alternator.
- Clutch and brake pedal position sensors.
- 4 x glow plugs.
- Throttle pedal sensor built into pedal and throttle body housing.
- Manifold and intake pressure sensors.
- Engine coolant temperature sensor.
- Diesel Particulate Filter (DPF) with pressure and temperature sensors.
- Digital crankshaft position sensor.
- Digital camshaft position sensor.
- ABS pump and ECU combined assembly.

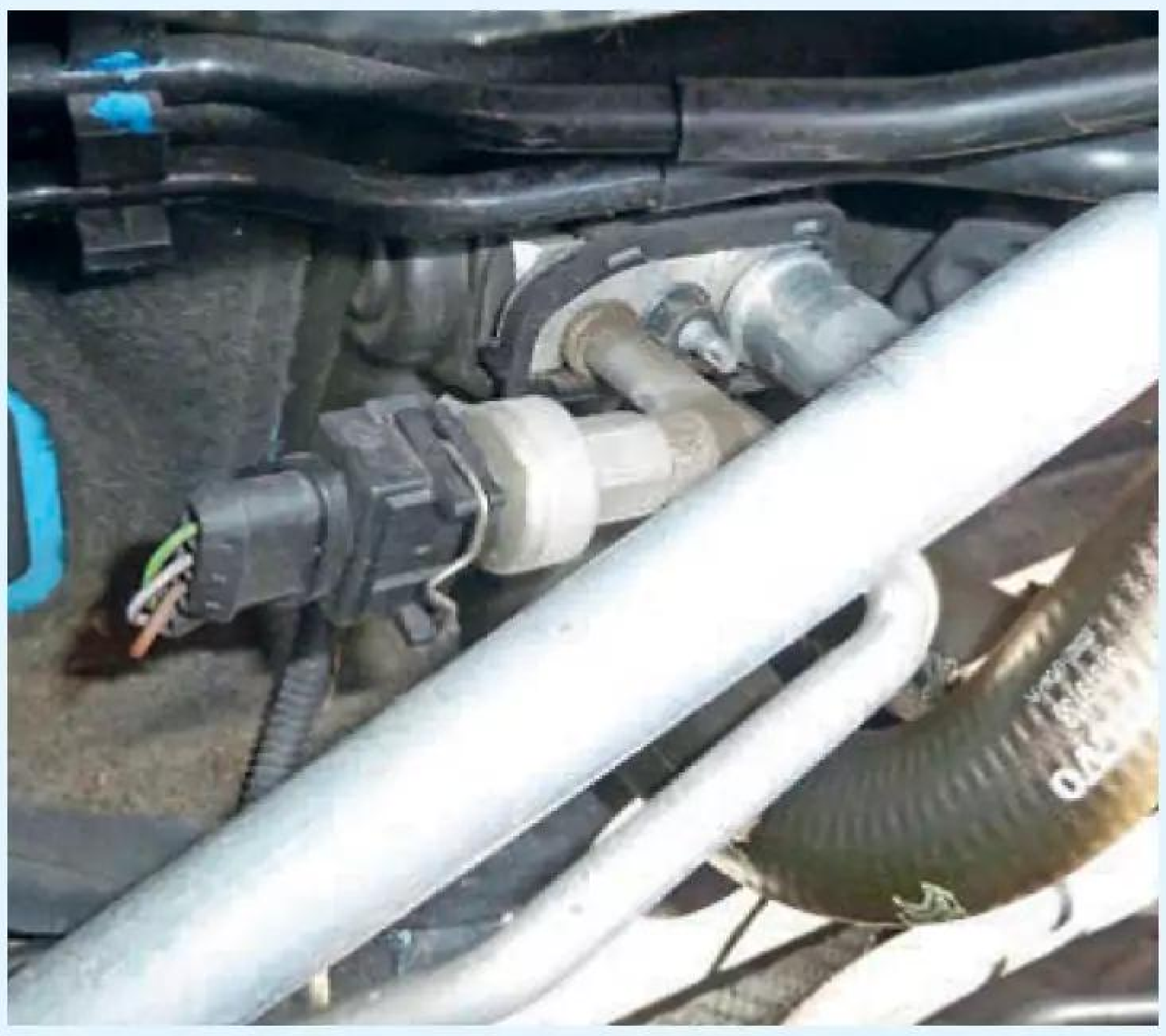
Typical Volvo V40 components



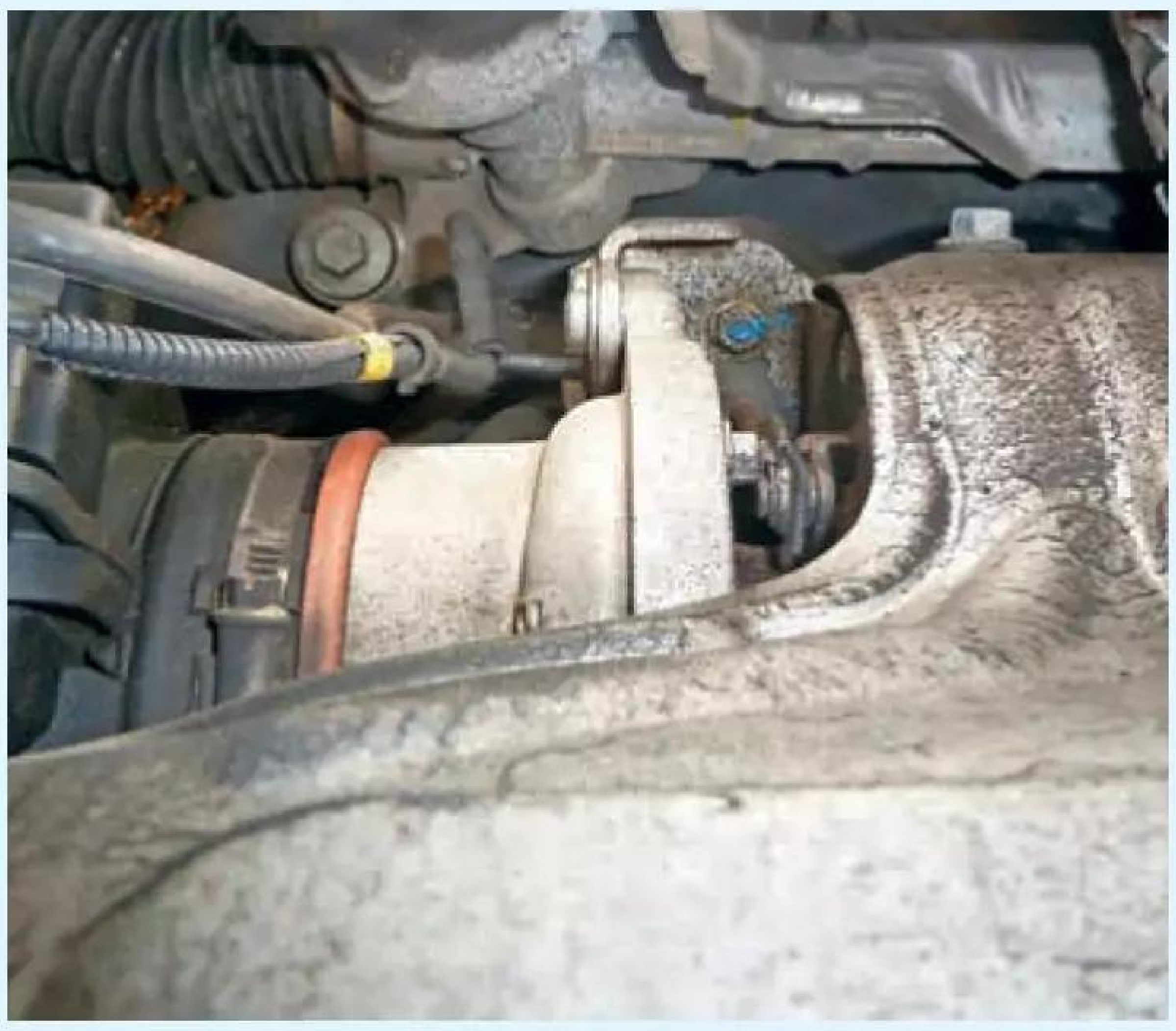
5 ◀ This important earth (ground) point is found on the left-hand front suspension turret. This one is in excellent condition, but if you have doubts about the cleanliness or security of the joint, unbolt the connection, clean, reassemble and protect with silicone grease.



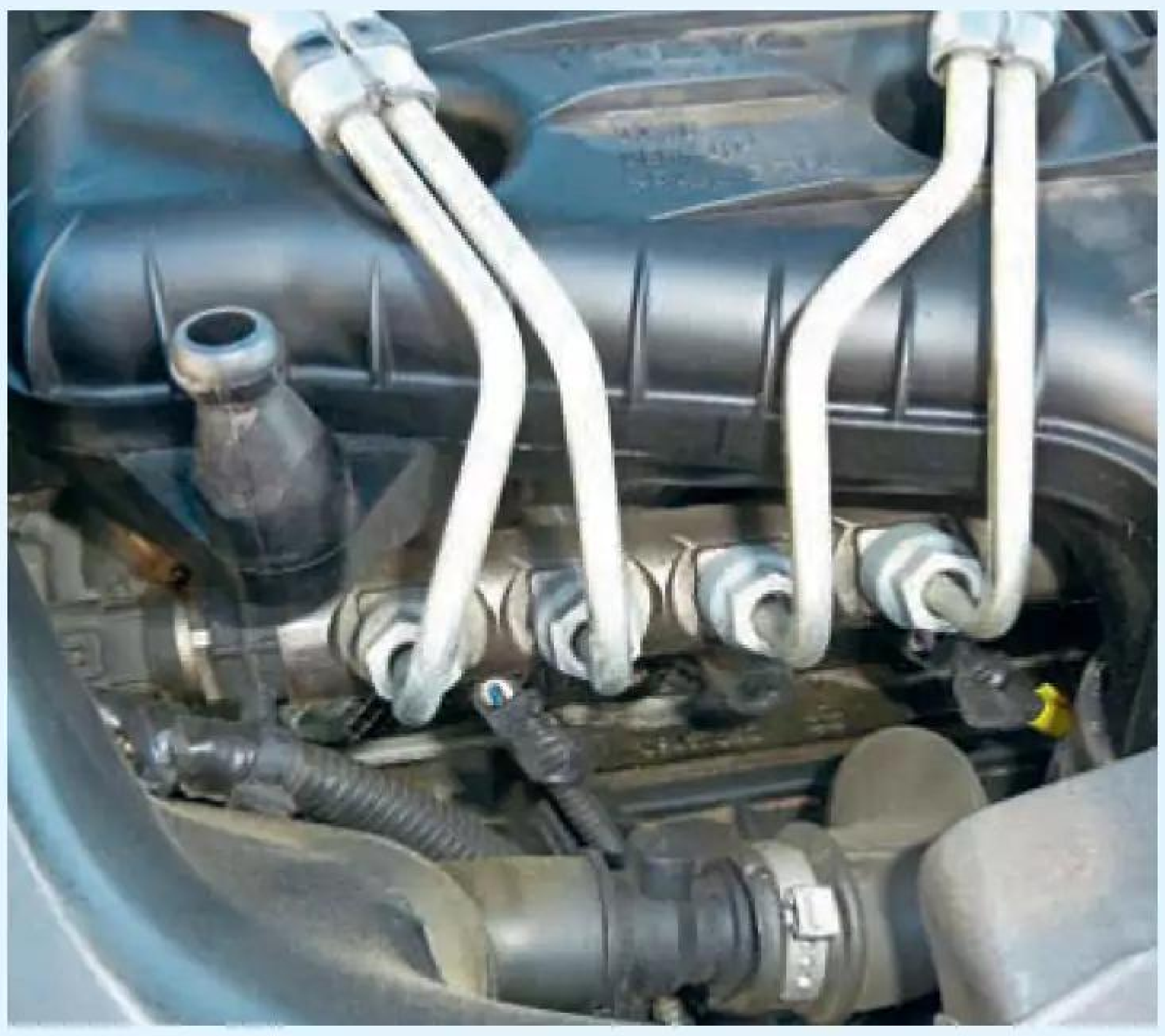
6 ▶ Found right at the rear of the engine compartment, and beneath the overhanging bulkhead, is the brake servo pressure sensor. Inspect the cables and plug/socket connector assembly for condition, cleanliness and security.



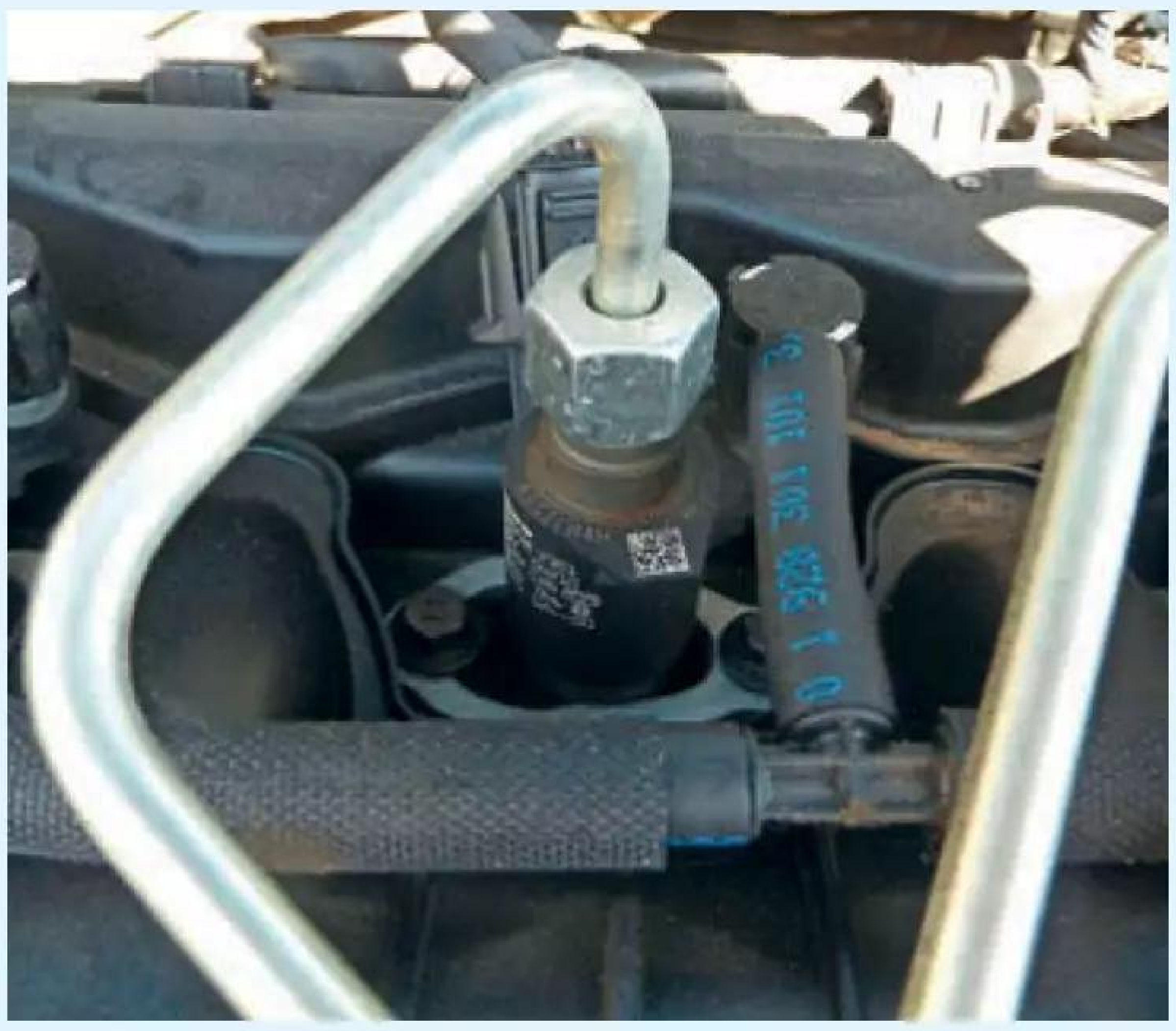
7 ◀ Tucked away within the rear part of the engine bay, approximately halfway across the car, is the pressure sensor for the air-conditioning system. Check the state of the cables and connections, in terms of contamination and condition.



8 ▶ Both the turbocharger and the Diesel Particulate Filter (DPF) are hidden away, located deep down at the rear of the engine compartment, and difficult to reach, or even to see clearly. The turbocharger requires a constant supply of clean engine oil to survive.



9 ◀ The fuel rail and its pressure sensor (that provides the ECU with data relating to the fuel pressure within the rail) mounted on the end of the rail, towards the right-hand side of the car, are both at the front of the engine and are readily accessible.



10 ▶ The fuel injectors are positioned at the top of the motor and are easy to reach for attention/renewal. The injectors bear code numbers, and when new ones are installed they need to be 'introduced' to the engine using suitable diagnostic equipment.

P04FA 'EGR – a component or system over-temperature condition', possible reasons being traceable to the EGR cooler or EGR valve.

Inevitably the fault will lie with the EGR valve actuator. If available on your diagnostic equipment, in 'special functions', select 'EGR', then activate. This takes over the ECU and operates the valves. You should hear and see movement; a simple resistance check on Pins 1 and 5 with the connector disconnected should show 4 ohms – anything higher than this will indicate a failure.

Edward advises that renewal of the actuator is fairly easy, but you have to carry out a 'teaching' process once the new unit has been fitted.

Fault 2:

DIESEL PARTICULATE FILTER (DPF)

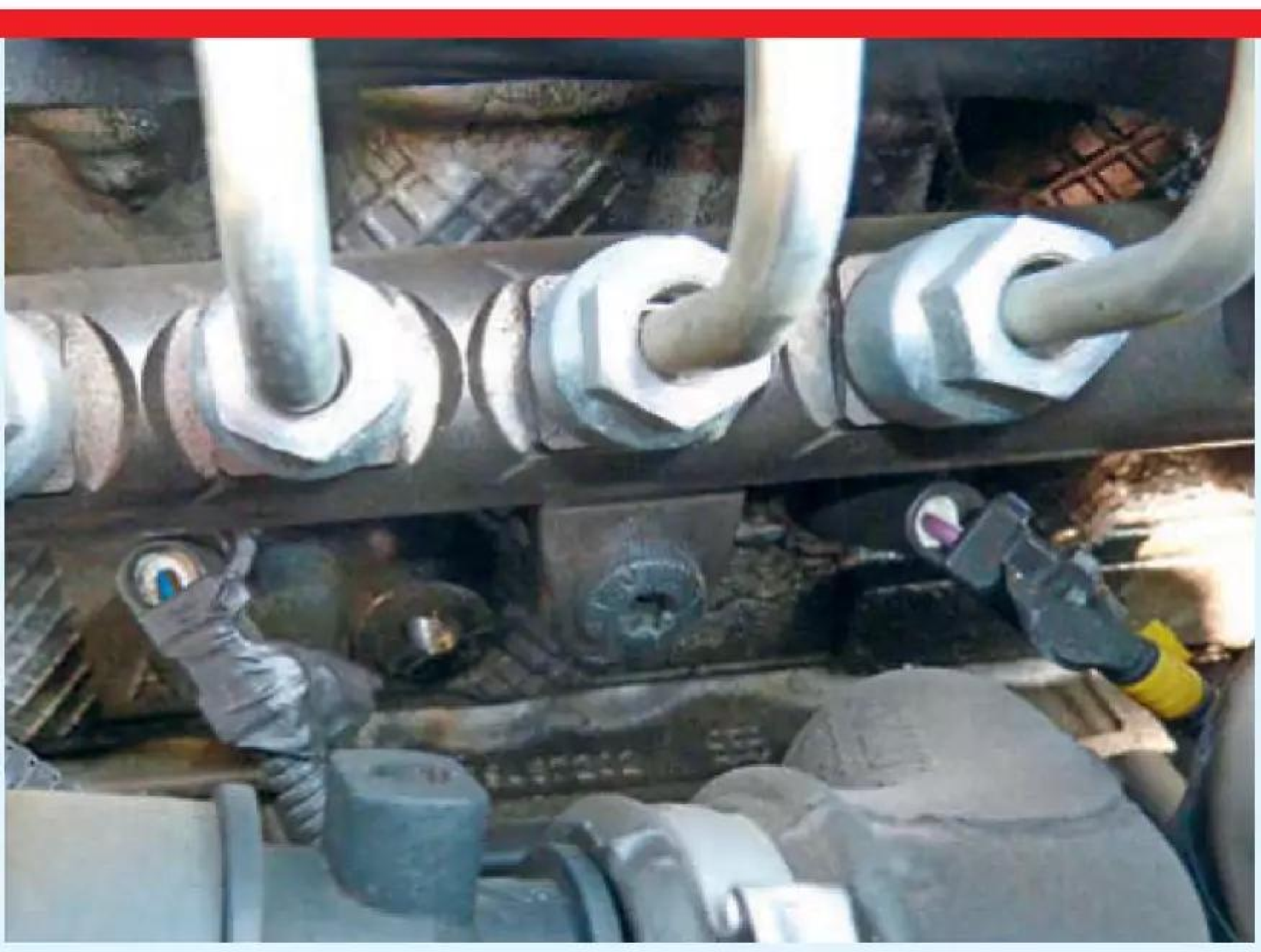
In this problematic situation, the car's driver will almost certainly notice a lack of power and engine management difficulties, with the DPF warning light illuminated, and with fault codes C1B14 and C1B15 stored.

The sensor can do funny things when it fails; you have to remember its purpose is to tell the ECU how full the DPF is, via a pressure to voltage signal. So, it's possible it might be regenerating more often than it should, or to the untrained eye a new DPF filter will need to be fitted.

Technical Specs

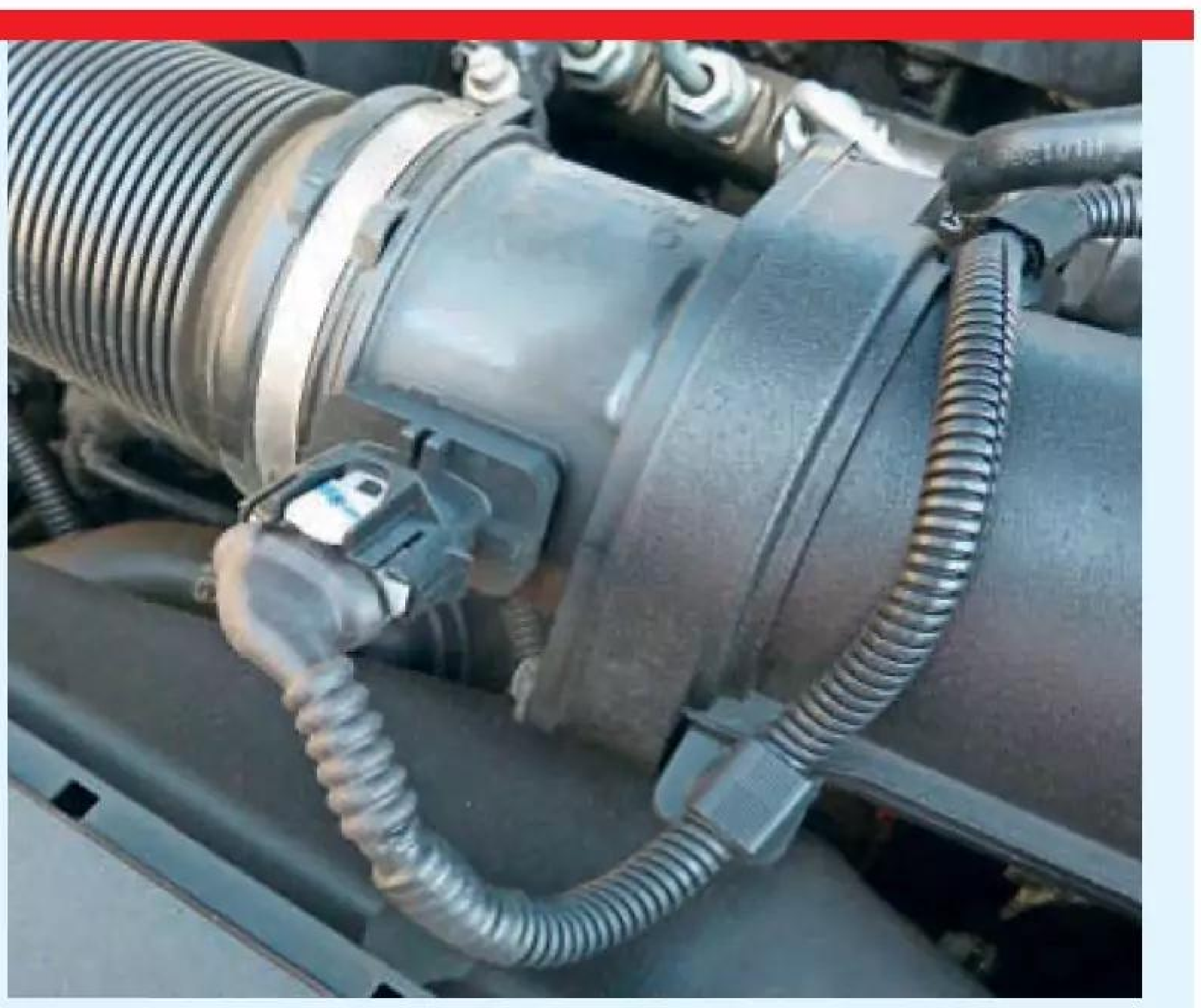
Actual values

Component	Value
Glow plug	0.4 ohms
Fuel injector (piezo type)	150,000-200,000 ohms
Crankshaft sensor	5-volt supply
Camshaft sensor	0-5 volt switching
Intake air flap control actuator	1-2 ohms



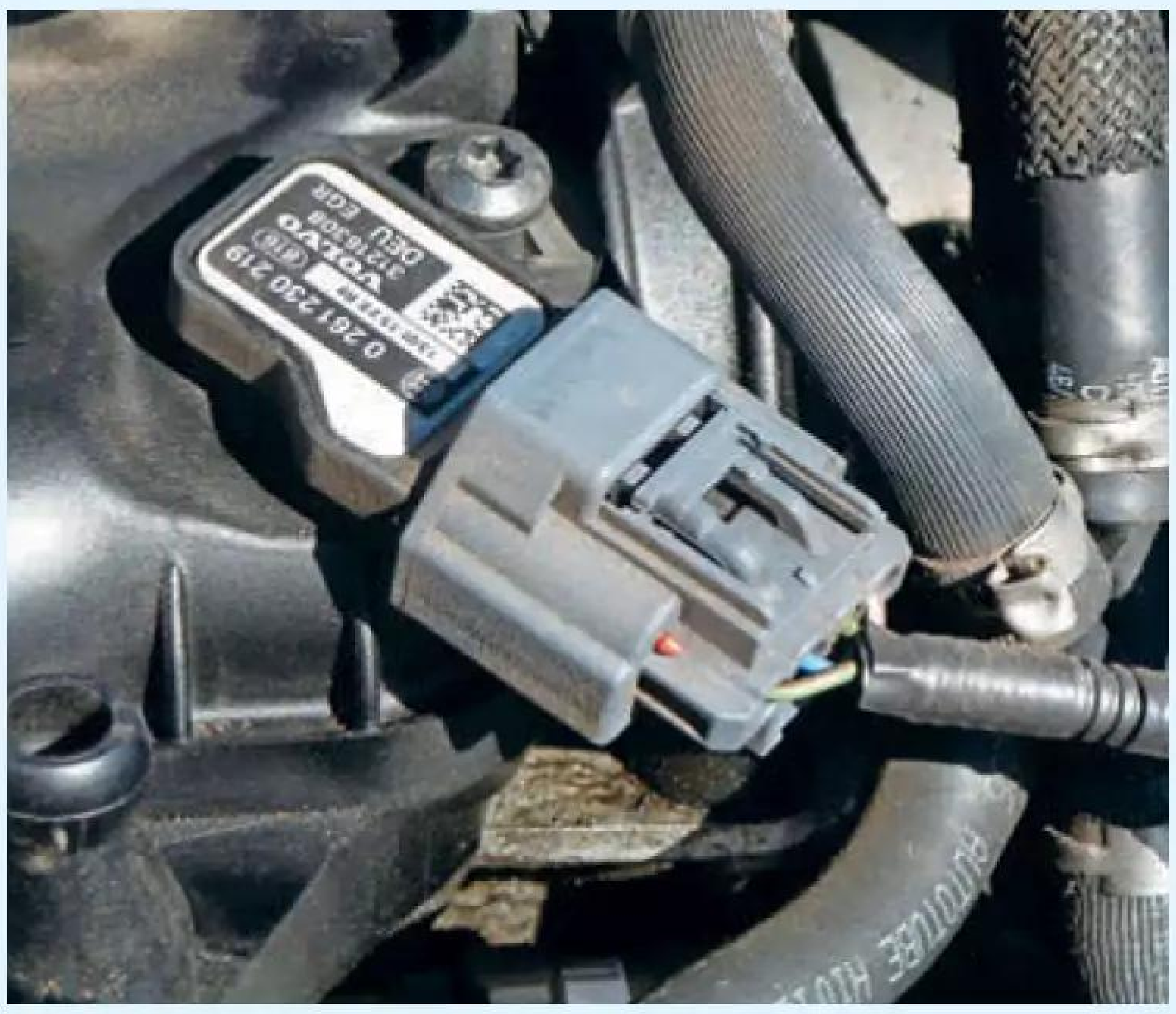
11 ◀ **Located just beneath the fuel rail, at the front of the engine and not difficult to check and to reach, are the glow plugs (two of which are visible in this shot). They need to function correctly to ensure easy starting, especially at low ambient temperatures.**

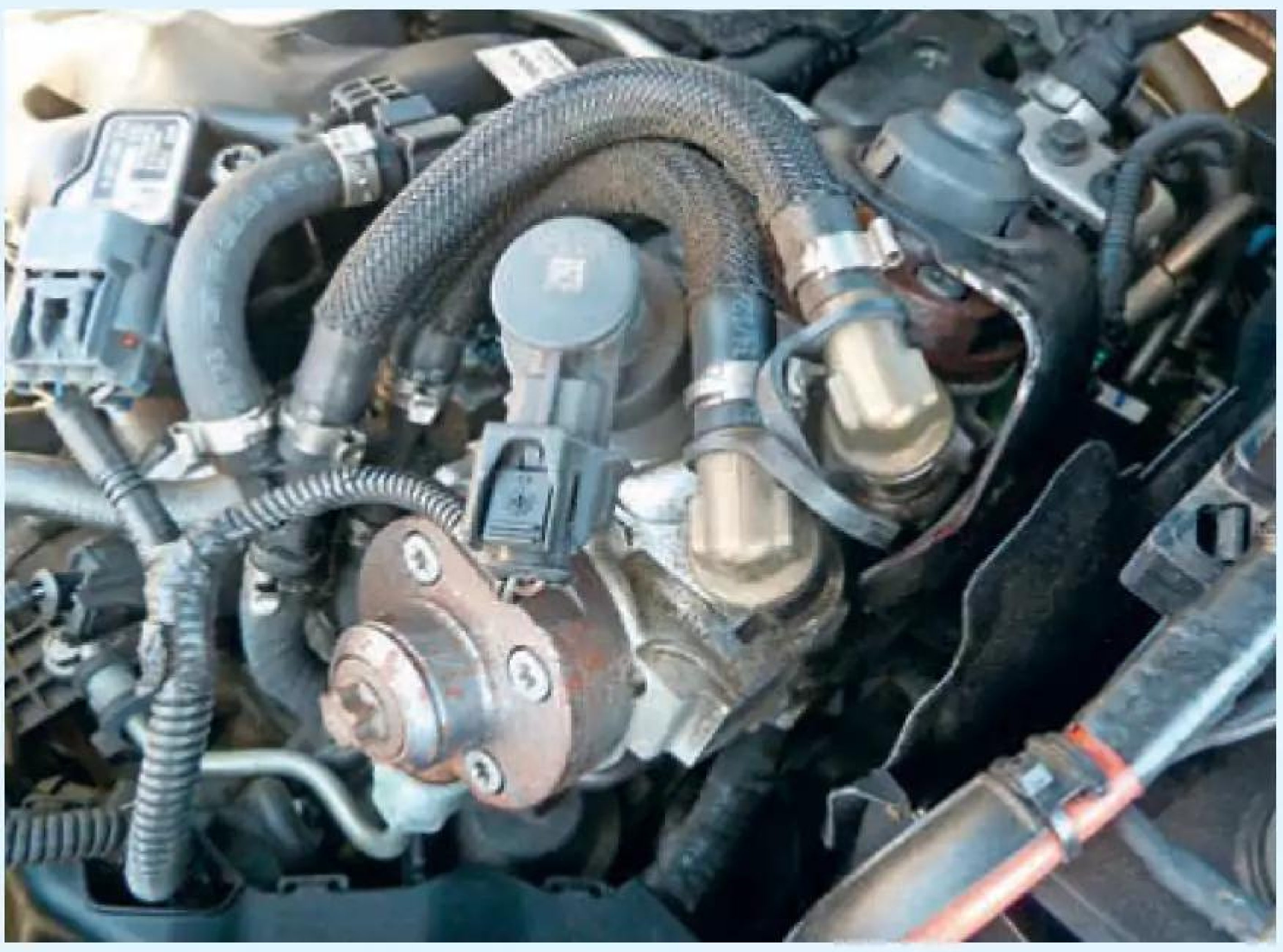
12 ▶ **As with many components around the V40's engine, the air mass (MAF) sensor, fitted within the intake trunking, is easy to reach and to remove if/when required. The sensor's job is to feed to the ECU information on the mass/rate of air flowing though the system.**



13 ◀ **The large air filter housing is prominently positioned at the top of the engine, towards the left-hand side. The lid is removed after releasing and removing the array of screws around its perimeter. When renewing the air filter, always clean the inside of the housing.**

14 ▶ **The Mass Absolute Pressure (MAP) sensor is located at the top of the engine, and is easy to reach and to renew if required. It supplies the ECU with information about the pressure within the inlet manifold at all times, helping to determine fuelling levels.**





15 ◀ **A vital part of the fuel supply system on this Volvo is the high-pressure pump. Check for physical deterioration and fuel leaks. Live data relating to fuel pressure and volume control, etc, can be accessed using diagnostic equipment such as the Launch X431 Euro Tab II.**

16 ▶ **The key fob assembly needs to be sound and with its battery in top condition. Renewing the internal battery is an important part of the maintenance programme on this V40. Edward recommends renewing the fob batteries every two years, as part of the car's servicing schedule.**

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USEFUL DATA

Below are shown the official recommended change intervals for the various components. However, Edward advises that these service/change intervals are at least halved.

Service intervals: Officially every 18,000 miles or 12 months, whichever comes first

Cambelt: Renew at least every 108,000 miles or 120 months

Diesel fuel and air filters: Officially renew every 36,000 miles or 24 months

Engine oil: Every 18,000 miles or 12 months, whichever comes first.

Oil Type: SAE 0W-30 fully-synthetic, to API/ACEA B5 specification

Capacity (service fill): 5.9 litres

Sump plug torque setting: 38Nm

Oil filter torque setting: 25Nm

Brake fluid: Every 24 months

Firstly, if available look at live data… in Edward's experience the signals jump around. It's also possible that by using a multimeter you can check the signalling. Remember that the higher the voltage the more blocked the filter is, ie. 0 volts means 'empty'; 5 volts indicates 'blocked'. Always fit good quality new sensors – there are many poorly manufactured copies available, and they can cause more trouble than good.

Fault 3:

FAILED GLOW PLUGS

This is a problem that almost certainly won't produce any lack of power but if the fault is left to its own devices it will create a problem in terms of the DPF filling and blocking…

The fault lies with the glow plugs. You have to remember that modern systems won't carry out a regeneration while faults are stored in the engine control system. Widely, people are of the mindset that because the car is starting OK the glow plugs don't need to be renewed.

However… Yes, glow plugs, in certain temperature ranges, help cold starting and they aid emission reductions, but this is not the whole story…

Carrying out a fault code check will show a fault code for the failed cylinder; be wary if you have codes set for all the cylinders as this can be a red herring and a fault with the controller. Note that a single cylinder code relates to the glow plug itself.

When testing, the required resistance for a good condition component, working as it should, is 0.4 ohms.

Edward always recommends installing a complete set of glow plugs because it's likely that if one fails the others might not be far behind.

A good soaking in penetrating fluid before you attempt removal helps ensure a positive result!

Fault 4:

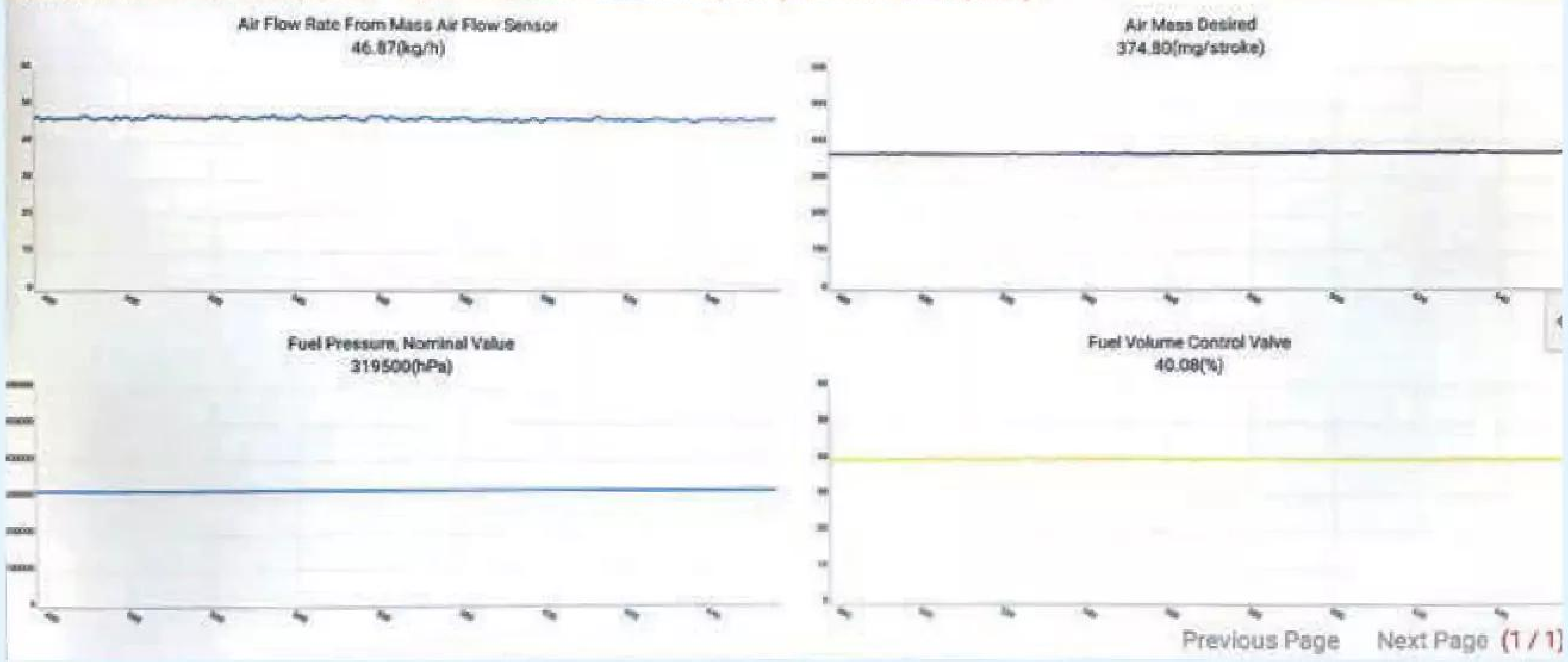
HEADLAMP UNIT CONDENSATION

Many examples of the Volvo V40/Ford Focus from the era under review suffer from really bad condensation in both the front headlamps – the problem being poor ventilation within the lamp units.

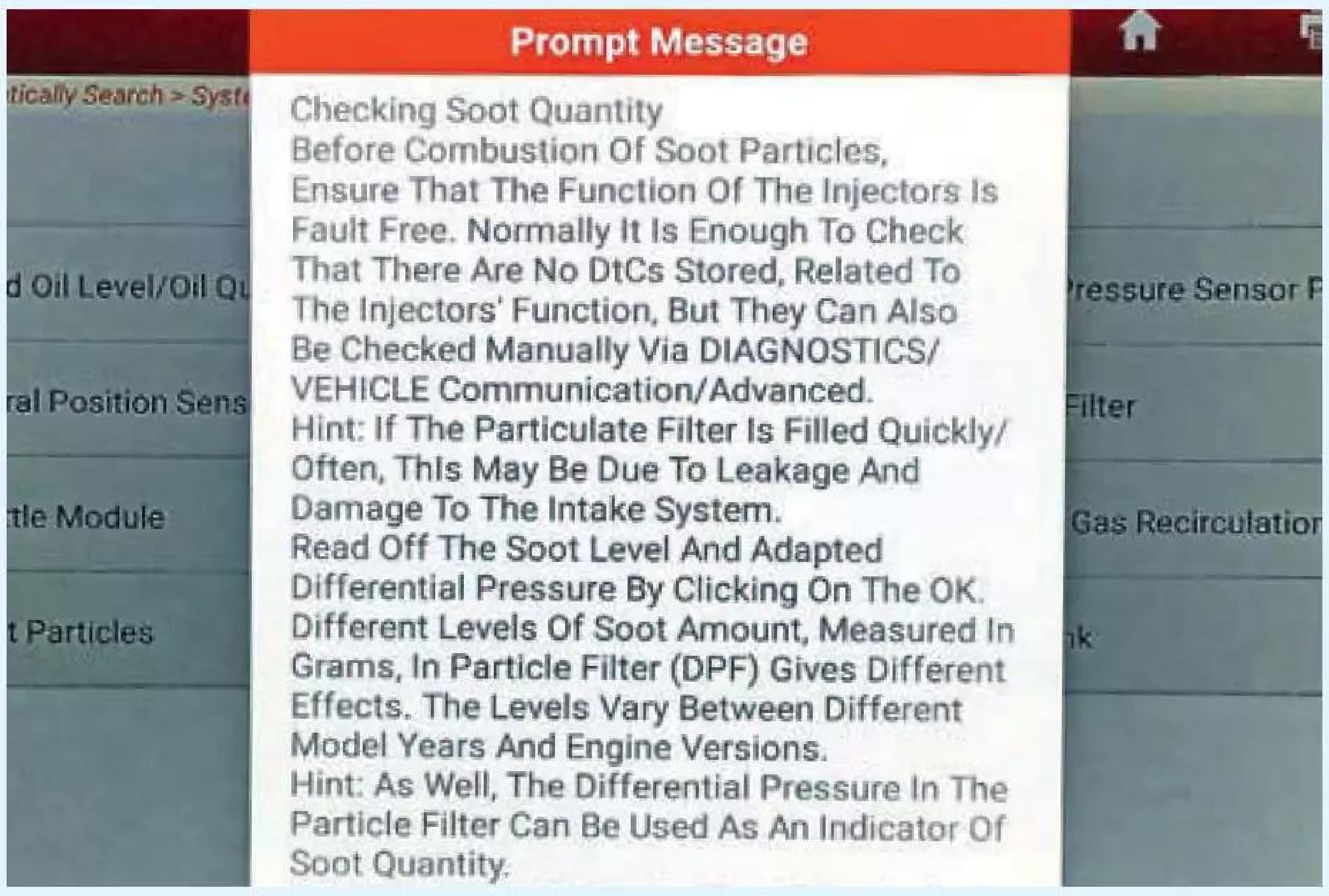
A really simply fix is to remove the rear lamp cover (the one that provides access to the bulbs) and add two small holes for further ventilation – "This works a treat", says Edward.

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11	MULTIFUNCTION CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A104	GLOW PLUG CONTROL MODULE
A107	FUEL PUMP CONTROL MODULE
A183	IGNITION SWITCH CONTROL MODULE
B6	ENGINE OIL PRESSURE SENSOR
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25-I	INTAKE AIR TEMPERATURE (IAT) SENSOR | 1
B25-II	INTAKE AIR TEMPERATURE (IAT) SENSOR | 2
B30	MASS AIR FLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B61	OUTSIDE AIR TEMPERATURE SENSOR
B72	HEATED OXYGEN SENSOR (HO2S)
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B86	ENGINE OIL LEVEL SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B121	BAROMETRIC PRESSURE (BARO) SENSOR
B131	EXHAUST GAS TEMPERATURE SENSOR

Typical Volvo V40 components


VOLVO V44.32 > Automatically Search > System Selection > DIESEL ENG(Fuel System/Combined System)
Air Flow Rate From Mass Air Flow Sensor
46.87(kg/h)
Air Mass Desired
374.80(mg/stroke)
Fuel Pressure, Nominal Value
319500(hPa)
Fuel Volume Control Valve
40.08(%)
Previous Page
Next Page (1 / 1)

18 **The Volvo's diagnostic socket is located at the base of the facia on the extreme right-hand side. This live data screen on the Launch X431 Euro Tab II is invaluable for assessing what's actually going on at any moment within the fuel system, in terms of fuel pressure, flow and volume, etc. Live data is useful when interrogating other systems too; you can check a number of faults via live data, to access signals being produced.**

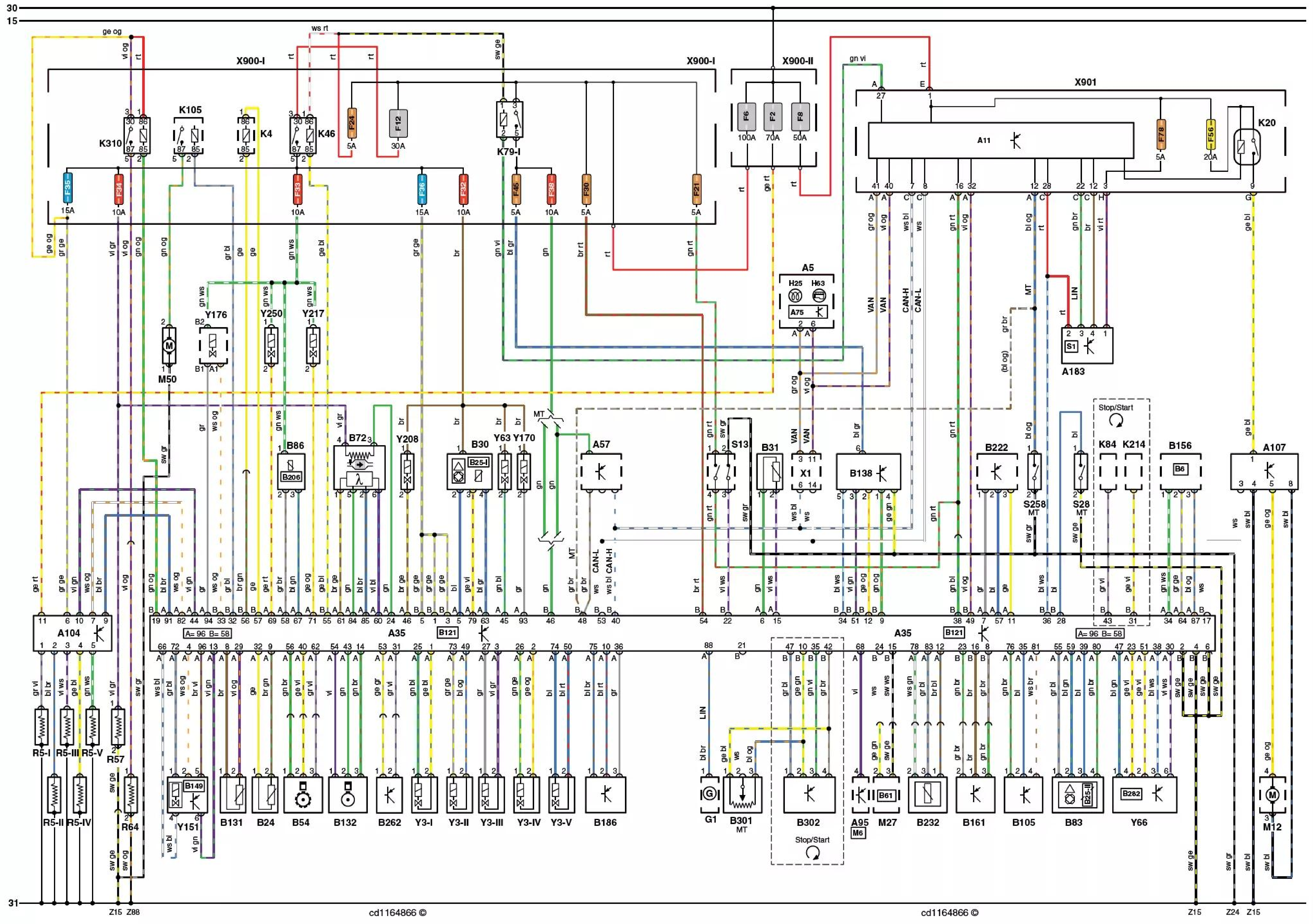


Checking Soot Quantity
Before Combustion Of Soot Particles, Ensure That The Function Of The Injectors Is Fault Free. Normally It Is Enough To Check That There Are No DtCs Stored, Related To The Injectors' Function, But They Can Also Be Checked Manually Via DIAGNOSTICS/VEHICLE Communication/Advanced.
Hint: If The Particulate Filter Is Filled Quickly/Often, This May Be Due To Leakage And Damage To The Intake System.
Read Off The Soot Level And Adapted Differential Pressure By Clicking On The OK.
Different Levels Of Soot Amount, Measured In Grams, In Particle Filter (DPF) Gives Different Effects. The Levels Vary Between Different Model Years And Engine Versions.
Hint: As Well, The Differential Pressure In The Particle Filter Can Be Used As An Indicator Of Soot Quantity.

19 ▶ **This screen shot relates to DPF regeneration; the tool enables the operator to initiate a 'forced regeneration' process if the car requires it – often if it has been used frequently for in-town running, where the exhaust seldom reaches the optimum temperature for 'self regeneration' to occur.**

Autodata
www.autodata-group.com

VOLVO V40 2.0D CIRCUIT DIAGRAM


30
15
31
X900-I
X900-II
X901
K310
K105
K4
K46
K79-I
K20
A11
A5
H25
H63
A75
A183
S1
Y176
Y250
Y217
M50
B86
B206
B72
Y208
B30
B25-I
Y63
Y170
A57
S13
B31
X1
B138
B222
S258
S28
K84
K214
B156
B6
A107
Stop/Start
A104
A35
B121
R5-I
R5-III
R5-V
R5-II
R5-IV
R57
R64
B149
Y151
B131
B24
B54
B132
B262
Y3-I
Y3-II
Y3-III
Y3-IV
Y3-V
B186
G1
B301
B302
A95
M6
M27
B232
B161
B105
B83
B282
Y66
M12
VAN
CAN-H
CAN-L
LIN
MT
Z15
Z88
Z24
cd1164866 ©

CODE	COMPONENT DESCRIPTION
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B149	EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR
B156	ENGINE OIL TEMPERATURE SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B206	ENGINE OIL QUALITY SENSOR
B222	TURBOCHARGER (TC) VANE POSITION SENSOR
B232	DIESEL PARTICULATE FILTER (DPF) PRESSURE SENSOR
B262	DIESEL PARTICULATE FILTER (DPF) TEMPERATURE SENSOR
B282	INTAKE AIR FLAP CONTROL ACTUATOR POSITION SENSOR
B301	CLUTCH PEDAL POSITION (CPP) SENSOR
B302	NEUTRAL POSITION (NP) SENSOR
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
F	FUSE
G1	ALTERNATOR
H25	GLOW PLUG WARNING LAMP
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K4	STARTER MOTOR RELAY
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K79-I	IGNITION MAIN CIRCUITS RELAY | **1**
K84	STOP-START SYSTEM RELAY
K105	ENGINE COOLANT PUMP RELAY
K214	AUXILIARY BATTERY RELAY
K310	FUEL FILTER HEATER RELAY
LIN	LOCAL INTERCONNECT NETWORK (DATA BUS)
M6	ENGINE COOLANT BLOWER MOTOR
M12	FUEL PUMP (FP)
M27	DOOR MIRROR ADJUSTMENT MOTOR, DRIVER
M50	ENGINE COOLANT PUMP MOTOR
R5-I	GLOW PLUG | **1**
R5-II	GLOW PLUG | **2**
R5-III	GLOW PLUG | **3**
R5-IV	GLOW PLUG | **4**
R5-V	GLOW PLUG | **5**
R57	CRANKCASE BREATHER HEATER
R64	FUEL FILTER HEATER
S1	IGNITION SWITCH
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S28	REVERSE GEAR POSITION SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
VAN	VEHICLE AREA NETWORK (DATA BUS)
X1	DATA LINK CONNECTOR (DLC)
X900-I	FUSE BOX/RELAY PLATE, ENGINE BAY **1**
X900-II	FUSE BOX/RELAY PLATE, ENGINE BAY **2**
X901	FUSE BOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y3-IV	INJECTOR | **4**
Y3-V	INJECTOR | **5**
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y66	INTAKE AIR FLAP CONTROL ACTUATOR
Y151	EXHAUST GAS RECIRCULATION (EGR) VALVE ACTUATOR
Y170	FUEL RAIL PRESSURE (FRP) CONTROL VALVE
Y176	AC COMPRESSOR VARIABLE DISPLACEMENT SOLENOID
Y208	EXHAUST GAS RECIRCULATION (EGR) COOLER BYPASS VALVE
Y217	TURBOCHARGER (TC) VANE POSITION ACTUATOR
Y250	OIL JET PISTON COOLING CONTROL SOLENOID
Z15	ENGINE BAY, LH SUSPENSION TURRET
Z24	BEHIND LH FRONT WHEEL ARCH LINER
Z88	BEHIND LH REAR SIDE TRIM PANEL
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

RENAULT CLIO 1.5 dCi

Tracing and fixing faults in electronic engine management systems

Renault's diesel-powered Clios can be attractive secondhand buys. All good so far, but how do they fare diagnostically? **Kim Henson** and **Edward Haggar** find out, looking closely at a 2009 example.

The Clio was launched at the Paris Motor Show in the summer of 1990, with UK sales starting in the following spring. Ever since then, and through five generations so far, this hatchback supermini model has been a popular buy in Britain and around Europe, being applauded for its practicality, comfort and commendable fuel consumption. Sporting versions have always been praised for their dynamic performance, and have achieved modern classic status in their own time too.

Third-generation Clios arrived in 2005, with the newcomers being built on a platform developed in conjunction with Nissan. In fact, Nissan's Micra and Note use the same underbody architecture as the Clio and the contemporary Renault Modus.

The Clio was rated with five stars in the EuroNCAP safety rating scheme, and in 2006 the model was awarded the European Car of the Year title.

A facelift was applied in the spring of 2009, improving equipment levels and the quality of materials used within the car.

Here we are taking the diagnostic lid off a third-generation 2009 Clio dating from July 2009. This is powered by the proven 'K9K' type four-cylinder, 8-valve, 1.5-litre dCi (standing for 'direct common-rail injection') turbodiesel engine, developed jointly by Renault and Nissan. The first examples of this motor appeared in 2001, with successive versions being improved through the years in terms of performance potential, fuel consumption and emissions. Ian Vaughan, who has owned from new the car we photographed, reports that it consistently returns more than 60mpg in real-world motoring.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Preparation

These engines are extremely reliable if well-maintained and you keep on top of the 'niggly' jobs – such as dealing with/keeping at bay the 'green death' corrosion (see *Fault 1*).

Apart from the difficult-to-reach fuel filter location this Clio is an excellent car for the do-it-yourself mechanic – it is just so easy to work on. However, note that the oil filter sits 'upside down', so oil can escape and make a bit of a mess when you are changing it.

Cambelt renewal requires the use of locking pins, though these are cheap to buy if you look around.

A useful little tip, as advised by Edward: whenever servicing these Clios, clean and oil the subframe bolts at the same time. This makes future clutch changes so much easier – and this applies to any car requiring subframe removal for a clutch change.

Fault 1:

ELECTRICAL CONTINUITY FAILURE

This problem can raise its ugly head in many areas of the vehicle, so is not a fault restricted to a specific component. Often referred to in the trade as 'green death', it can affect any Renault models of this era, and is not restricted just to diesel versions.

Edward has seen, for example, 'no start' situations due to corrosion affecting starter terminals No.15 and 30, and the screen wipers operating without being switched on...

He advises that such corrosion can cause very strange faults, and that when carrying out checks it should be borne in mind that if it is affecting a supply line, a diagnostic assessment may throw up numerous sensor fault codes, since the supply cables are shared.

Tool of choice

▶ The Launch X431 Euro Tab II diagnostic tool is perfect for use with this Clio. On being connected via the diagnostic socket, the equipment automatically identifies the actual vehicle and its main drivetrain components. The operator can then set the tool to display a wide variety of screenshots, including (for example) those relating to system components/computers present around the vehicle, live data – plus injector codes and performance (and so on).

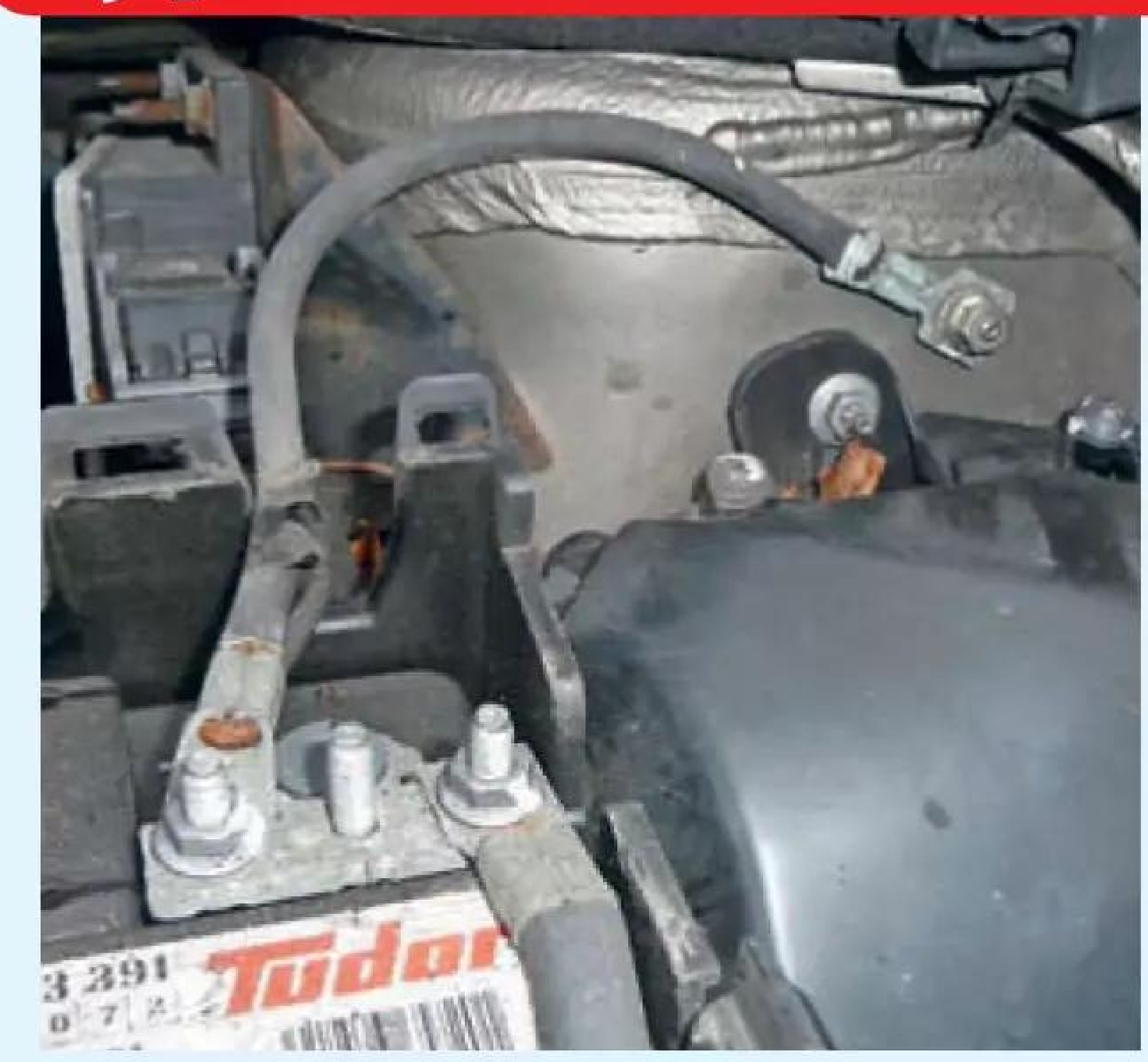
In addition, the tool can easily and rapidly be setup so that the operator can operate individual systems and components remotely (by Bluetooth).

The Launch equipment can be used for a wide variety of other makes and models too.

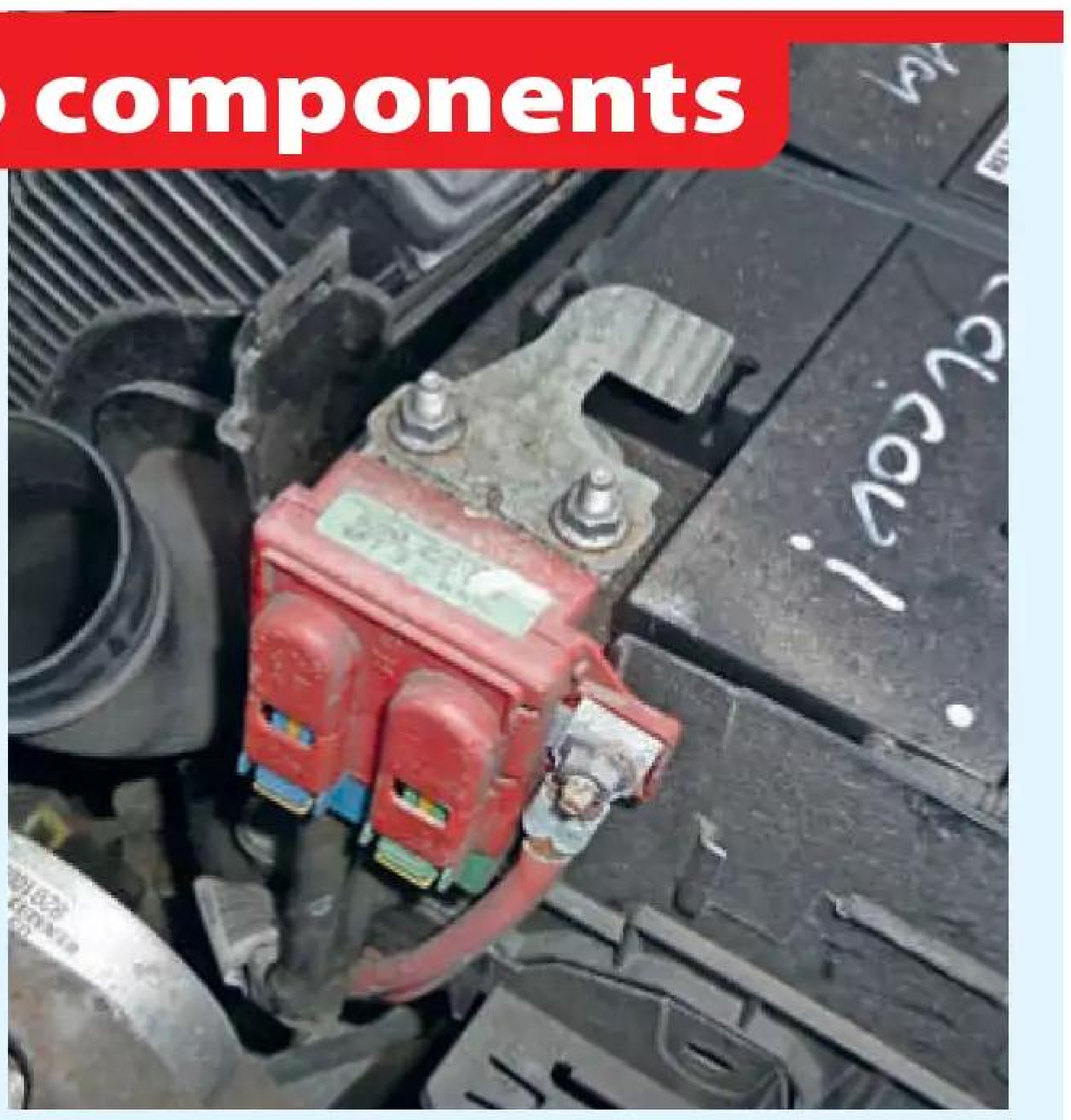
TYPICAL FAULTS

1. ELECTRICAL CONNECTION CORROSION ('GREEN DEATH')
2. NON-STARTING/EXTENDED CRANKING
3. ENGINE MANAGEMENT LAMP ILLUMINATED, EXTENDED CRANKING WHEN STARTING, LACK OF POWER
4. ELECTRICALLY POWERED DOOR WINDOWS FAIL TO OPERATE

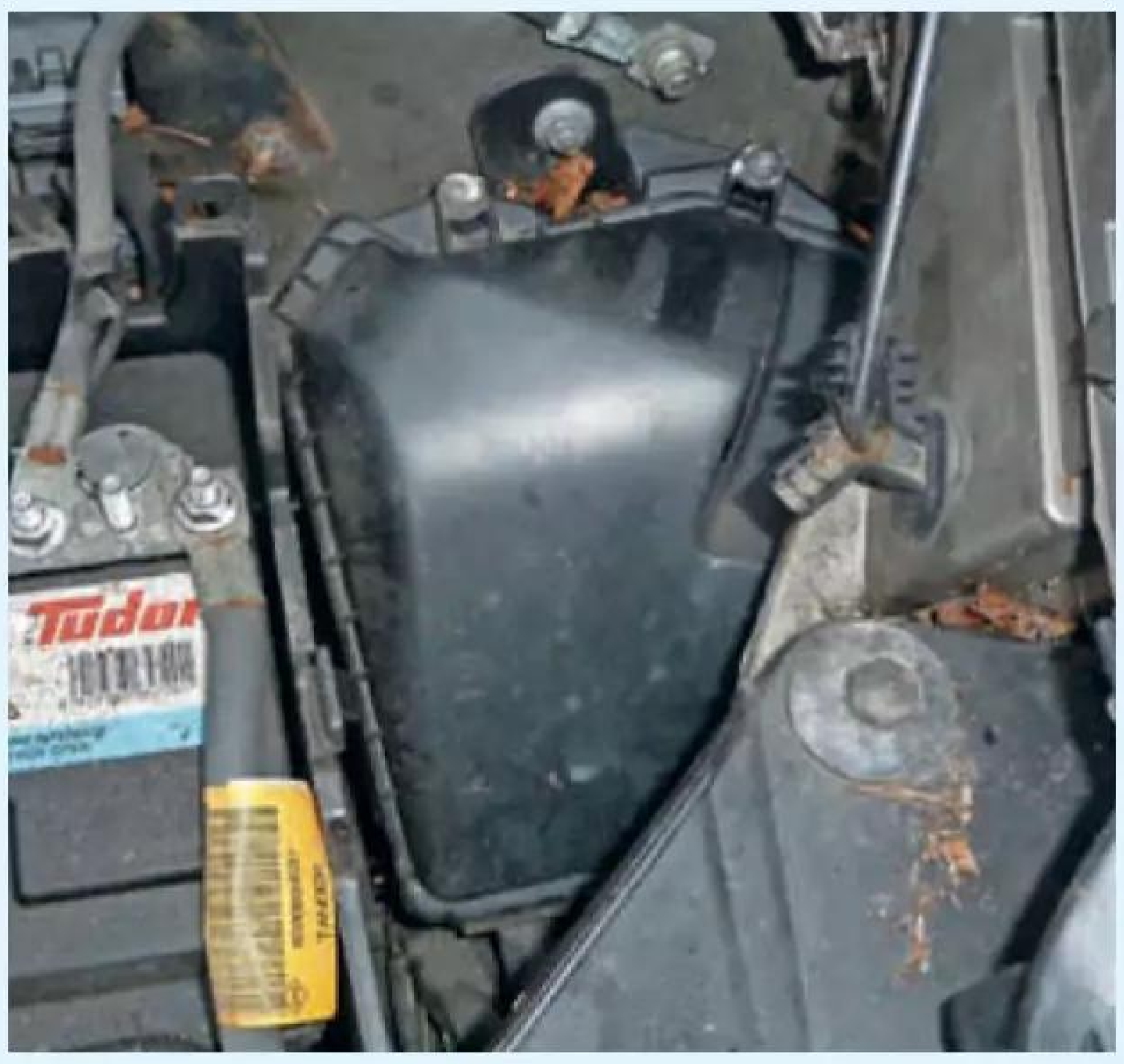
Typical Renault Clio components



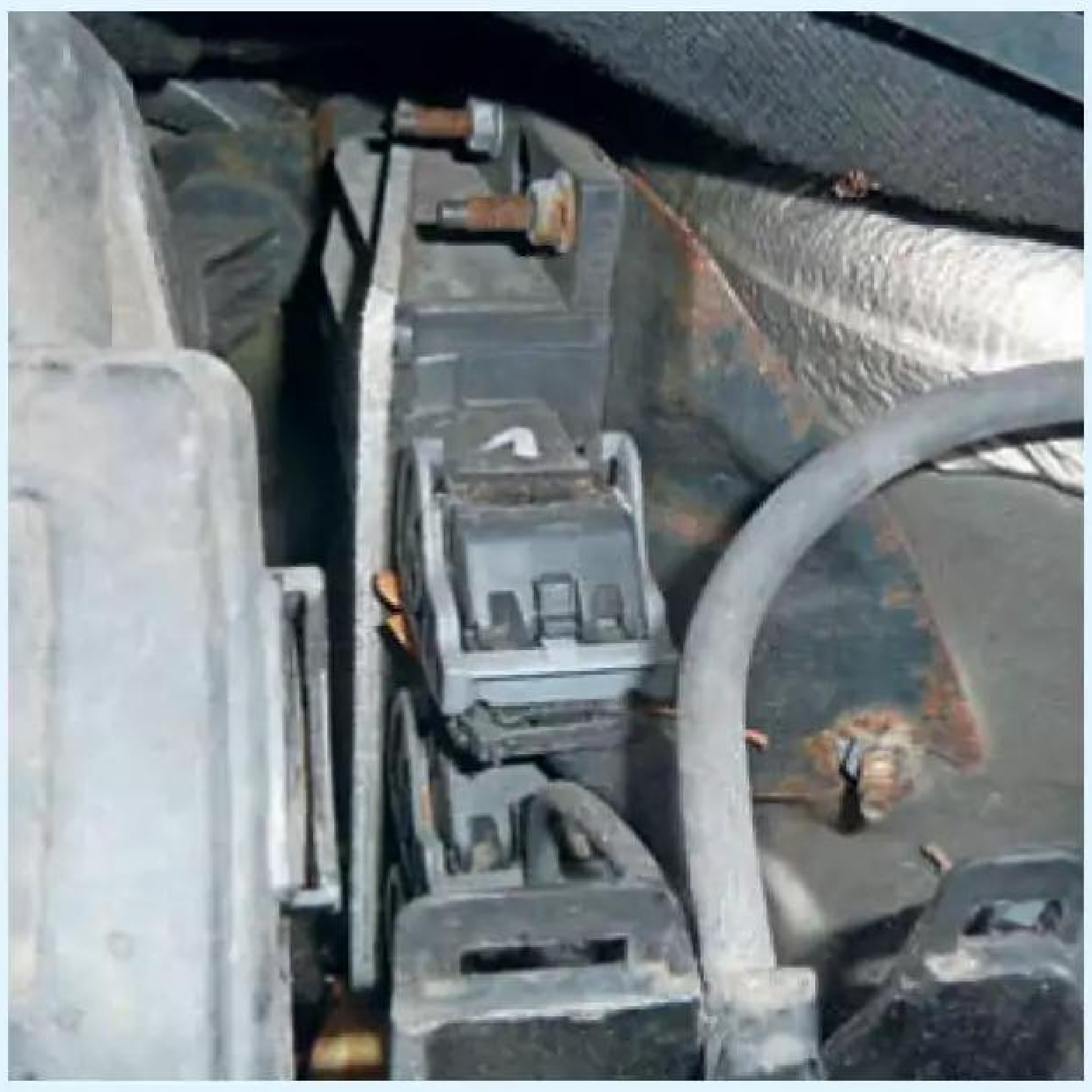
1 **The negative earth or ground terminal of the battery is connected via the short cable visible in this shot to the front of the left-hand front suspension tower. It is vital that the connections are clean, sound and secure; frequently/ regularly check these aspects.**



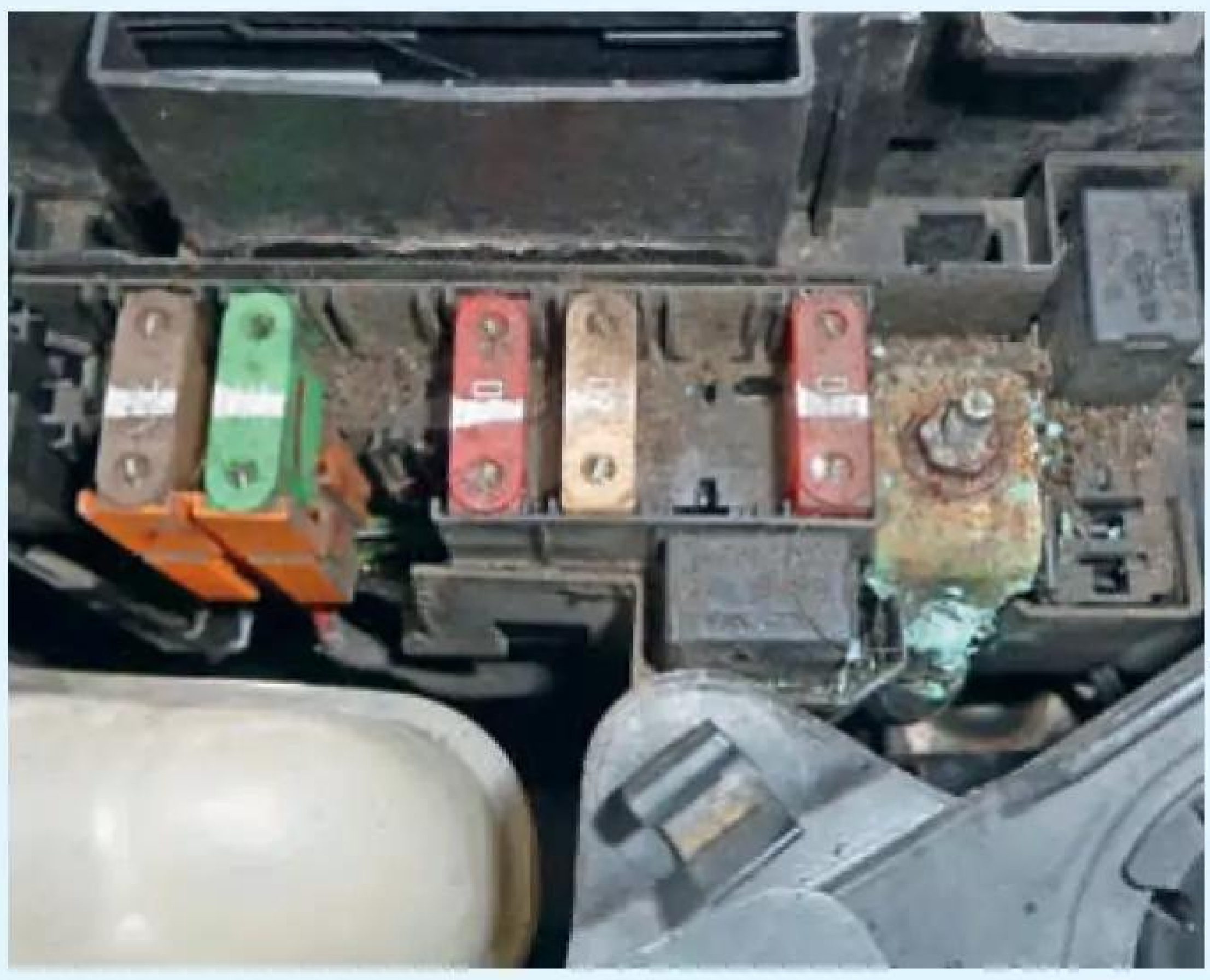
2 **The positive terminal assembly incorporates vital electrical fuses. Take great care if ever jump-starting to ensure that the correct specified procedures are adopted (consult the handbook), or you may blow a critical fuse. Always remember to connect the negative terminal last.**



3 **To the left of the battery (and in the centre of this shot) is Renault's UCH body control module assembly/ underbonnet fuse and relay box, incorporating a lid secured by two Torx screws (T27). Trouble can arise within this assembly. Keep moisture at bay!**



4 **The vehicle's main ECU is located high up towards the rear of the engine compartment, on the left-hand side, and attached to the left-hand front suspension tower. In this position it is out of the way of most road spray and airborne moisture.**



5 **◀ This underbonnet fusebox/ junction box assembly is at the front of the engine bay, on the left side, and vulnerable to moisture/dirt penetration. Remove the cover and carefully clean the internal components. WEARING GOGGLES, gently wire-brush away corrosion from the main cable connection, and coat with silicone grease for future protection.**

6 **▶ A clean air filter element helps the inherently efficient Renault diesel engine to breathe. This filter element has done its job and is due for replacement. Its housing is located at the top of the engine bay, left side. Release the lid's two clips, withdraw element, clean debris/leaves from inside housing; install new element, refit lid.**

Edward recommends frequent inspection of the wiring/connections, and checking for signs of green, or indeed any, corrosion. A good cleaning of the affected sections, and a coating of light grease or silicone grease will prevent the problem from worsening. If excessive corrosion is discovered, replacement of the cables and/or connection plugs/ sockets may be necessary.

Fault 2:

CHOKED FUEL FILTER

The requirement for extended cranking of the engine/non-starting may be due to a blocked fuel filter. Due to its location within the right-hand inner/ outer wing void, to gain access to it requires removal of the road wheel and inner wheelarch liner.

A simple test is to check the live actual values via the tester equipment and observe the fuel pressure being indicated – you should see 200+ bar when cranking. Anything a lot less than this shows either low fuel pressure or indicates that the pressure is being lost en route.

If available, you could employ a fuel pressure tester to check the pressure at different points in the system, to pinpoint the fault. However, if there is no known history of the fuel filter having been changed, renew it regardless.

Edward recommends renewing the filter at least annually. When renewing the filter, note that the fuel pipes and the filter are colour-coded.

A useful aspect of the system as fitted to this Renault is that the company installed a hand-operated 'bulb type' primer within the right-hand side of the engine bay. If the system needs to be primed, simply squeeze the bulb to draw up fuel (when the bulb is full, it will feel solid).

Fault 3:

STICKING EGR VALVE

If it's necessary to crank the engine excessively before it will start, and if the engine management warning light is illuminated, while the engine also lacks power (the driver may say that it feels as if it's 'holding back'), the problem lies with the exhaust gas recirculation (EGR) valve sticking. This will be because the valve is clogged/coked-up, resulting in either too much air flow, or a lack of air flow.

The stored fault code will likely be P100C 'Exhaust gas recirculation valve position sensor circuit'. If your test equipment allows, carry out a function check on the EGR to establish if there is any movement.

⇨

It's worth removing and cleaning the valve, rather than just renewing. If you do have to fit a new EGR, install a high-quality component. Remember too that it will then be necessary to carry out a 're-learn' operation via the diagnostic tool.

Fault 4:

WINDOW WINDER MOTOR OR SWITCH

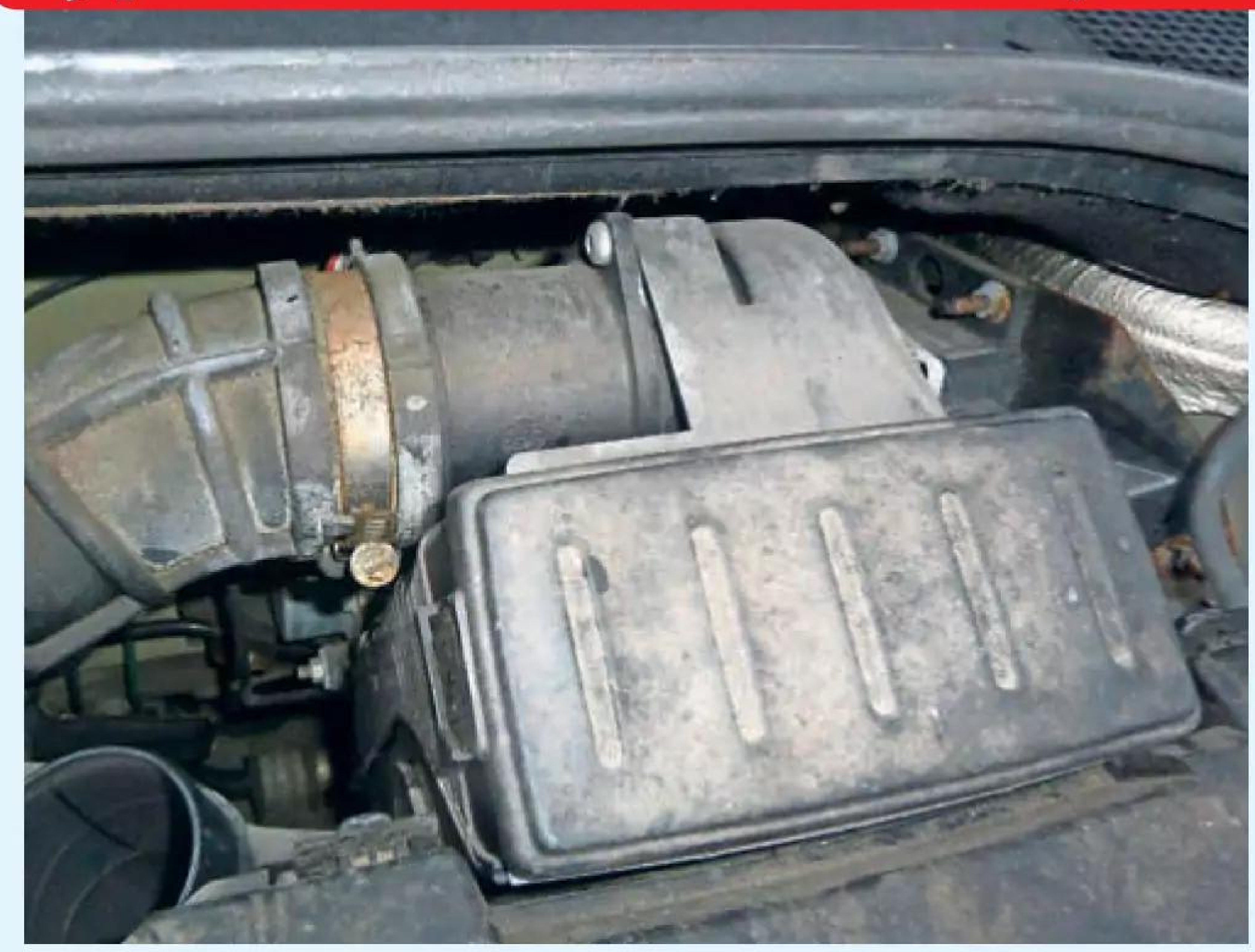
Annoying faults are often encountered with electrics on Renaults of this era. In particular the powered door window operating motors and switches are prone to failure. A simple test is to remove the relevant door card/trim panel – and while using a voltmeter – check for power supply to the motor when the switch is operated either way (up or down). If a voltage supply is found, the

ENGINE MANAGEMENT

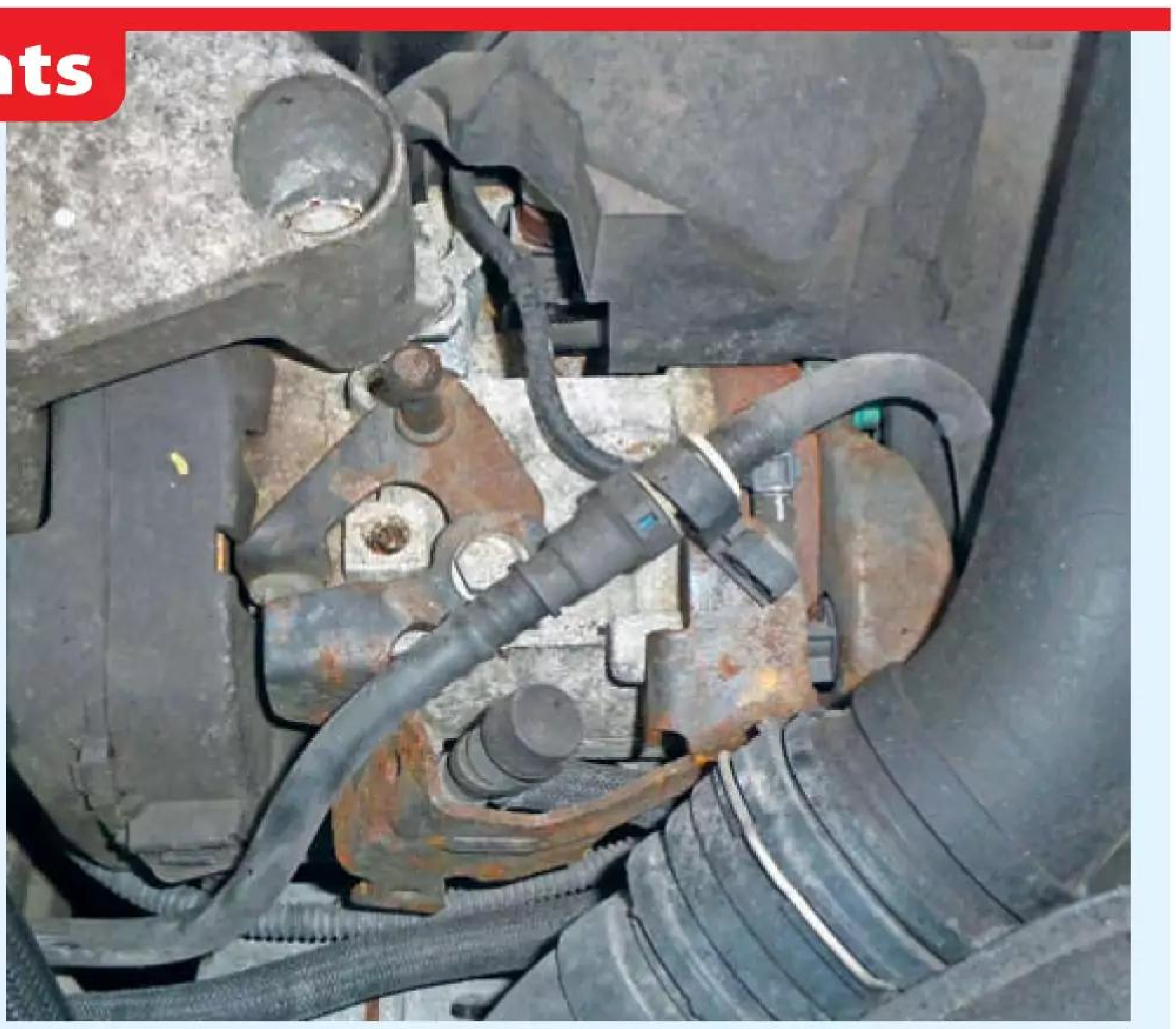
The management system used on this Clio incorporates these components:

- Multiplug ECU.
- Coolant temperature sensor.
- EGR valve with built-in position sensor.
- MAP sensor.
- Solenoid-type fuel injectors.
- Accelerator pedal sensor.
- Throttle position sensor.
- Engine control relay.
- Glow plug (one per cylinder).
- Crankshaft and camshaft sensors.
- Pedal-mounted clutch position sensor.
- High-pressure pump – driven via cambelt.
- Low pressure turbo.

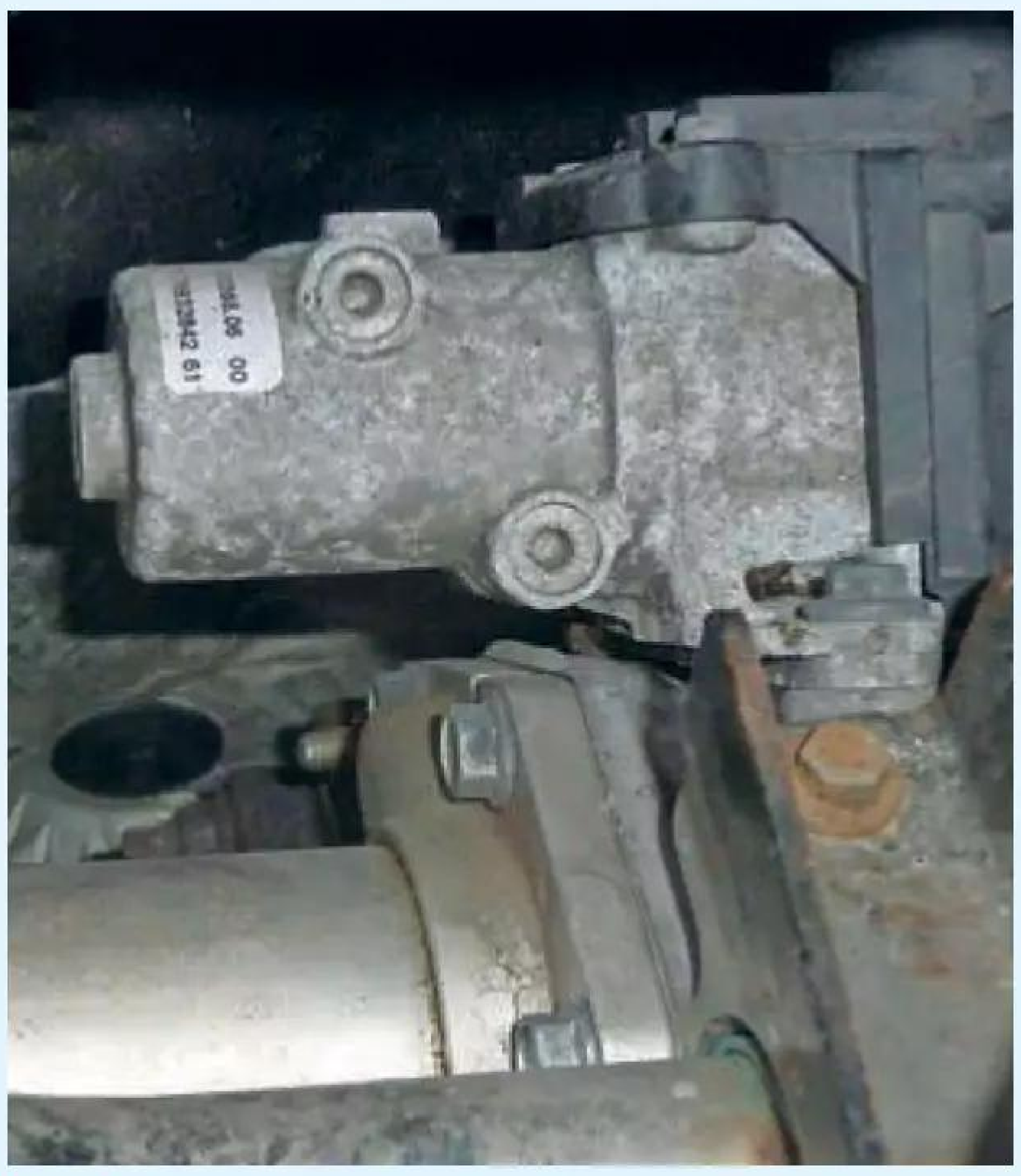
Typical Renault Clio components



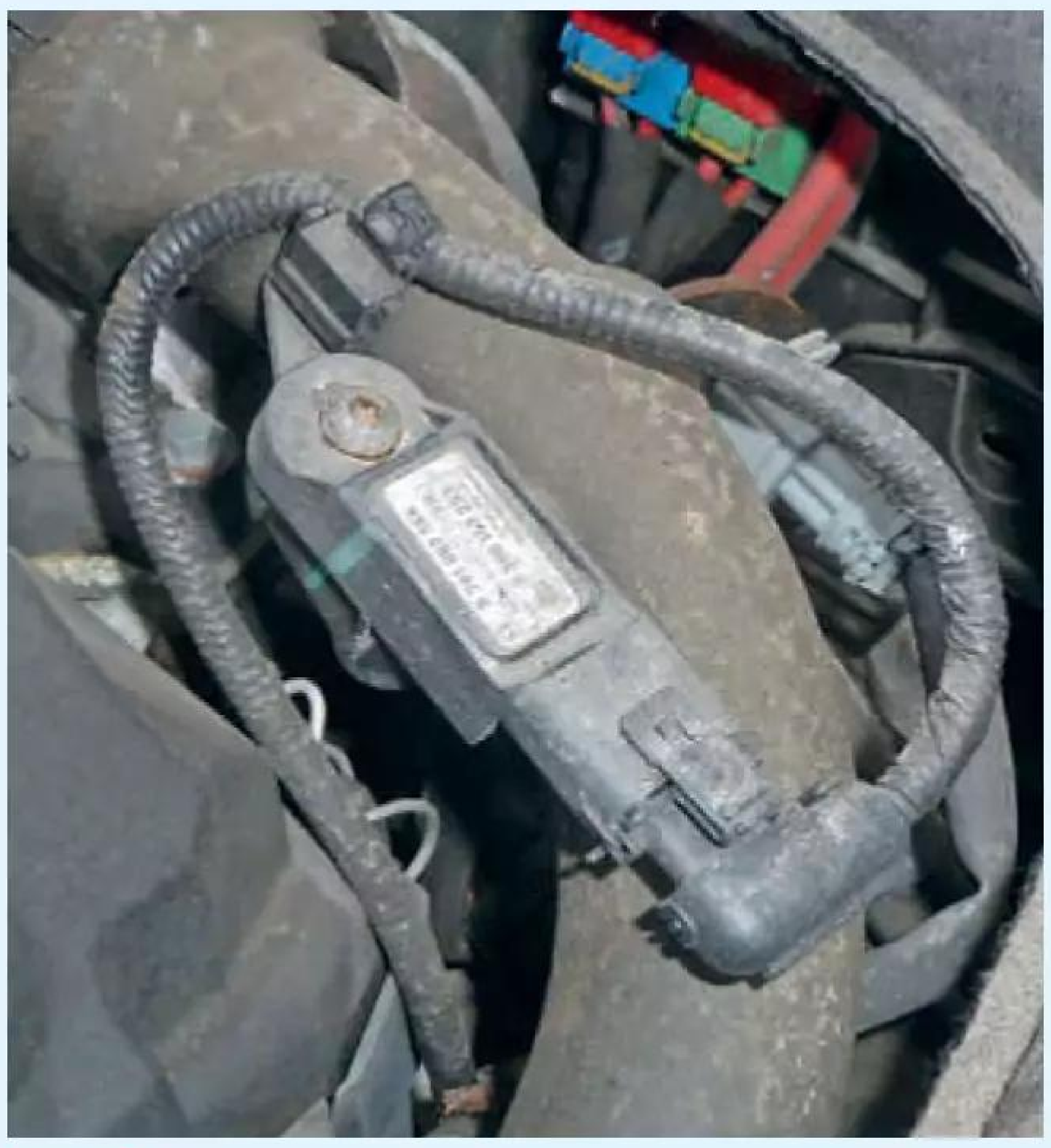
7 The air mass sensor, located within the intake trunking, monitors/evaluates the mass (rate) of air passing through the system, feeding this information to the ECU which uses this data as one of the determining factors in setting fuelling levels at any given moment.



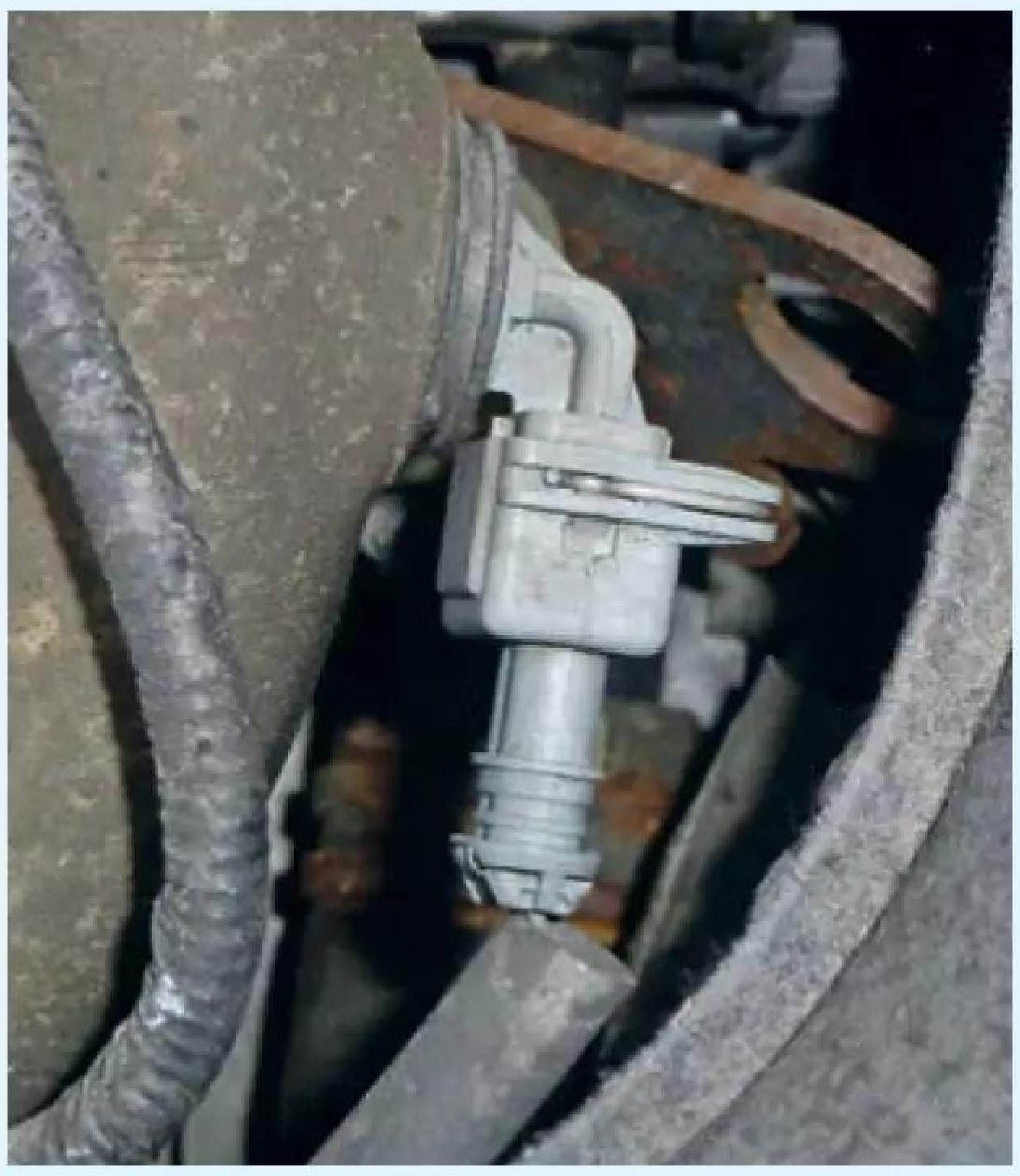
8 The cambelt-driven high-pressure diesel fuel pump is usually reliable on these dCi engines. A special locking tool is required for setting the camshaft and crankshaft timing, but this implement is inexpensive to buy.



9 Installed right at the back of the engine compartment is the EGR valve assembly and the EGR valve cooler (just beneath it). If enough time is available, at each service remove the EGR valve and clean it, extending its life and ensuring continuing good fuel economy.



10 The mass absolute pressure (MAP) sensor, visible in the centre of this photograph, keeps tabs on the pressure within the inlet manifold, delivering this information to the ECU – which in turn uses this to calculate/adjust fuelling levels as required, at all times.



11 The grey component shown here (found just to the left of the MAP sensor) is the air temperature sensor. It provides the ECU with ambient air temperature information, helping ensure that appropriate quantities of fuel are delivered at all times.

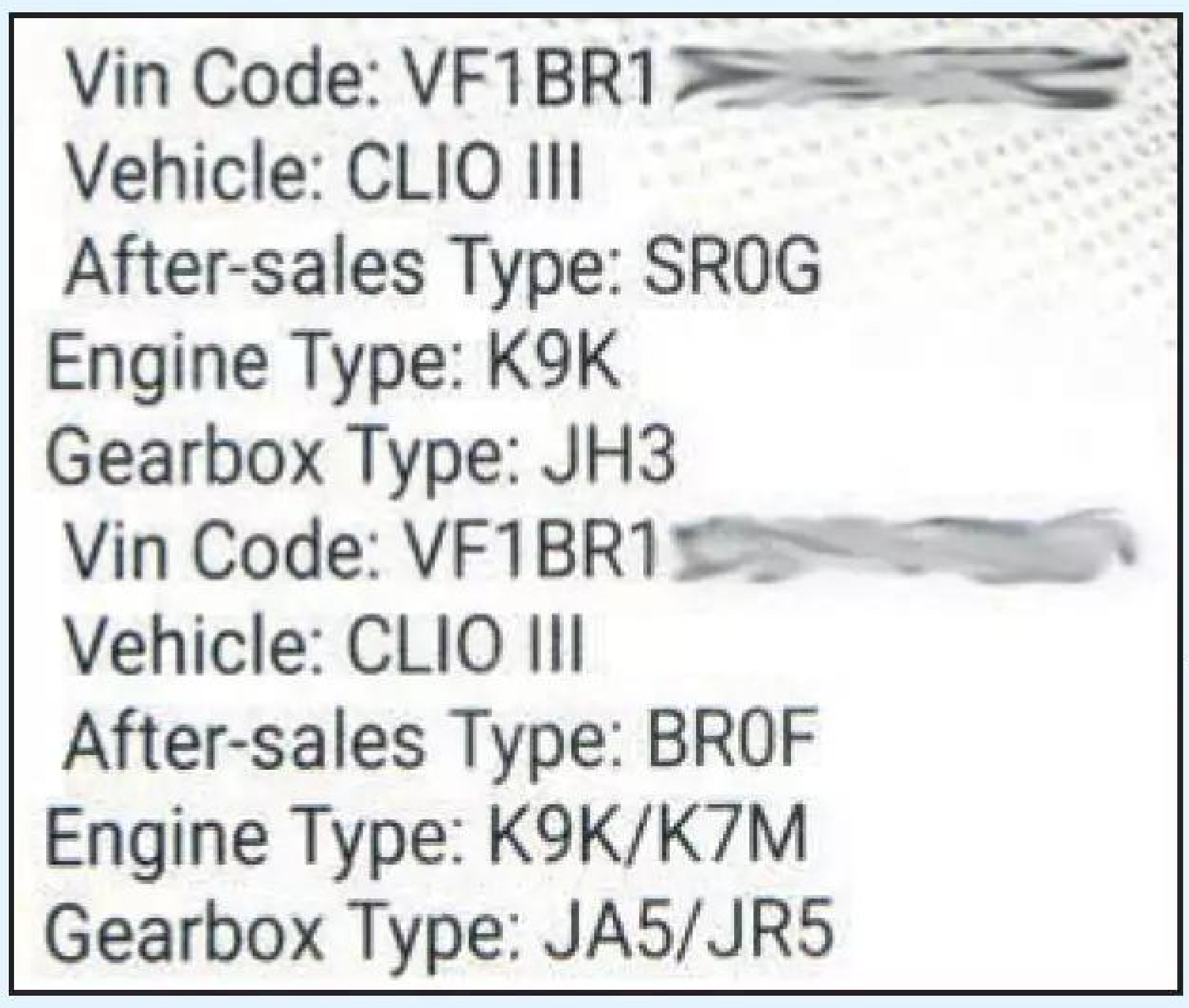
12 ◀ **The fuel injectors are positioned at the top of the engine and normally concealed by a cover. On this car the injectors are still the original units, operating as they should. If new injectors are fitted they must be coded to the vehicle using suitable diagnostic equipment.**

Technical Specs

Actual values

Component	Value
Fuel/injection pump assembly	Delphi
Pump type	Common rail
Injection sequence	1-3-4-2
Injector nozzle	Delphi
Fuel injectors	0.2 ohms
Nozzle opening pressure	bar1400
Intake air temperature (IAT) sensor	20°C 2353-2543 ohms
Coolant temperature sensor	–10°C 11,370-13,630 ohms 80°C 272-288 ohms
EGR solenoid	8 ohms
EGR valve position sensor pins 2-4	2400-5600 ohms

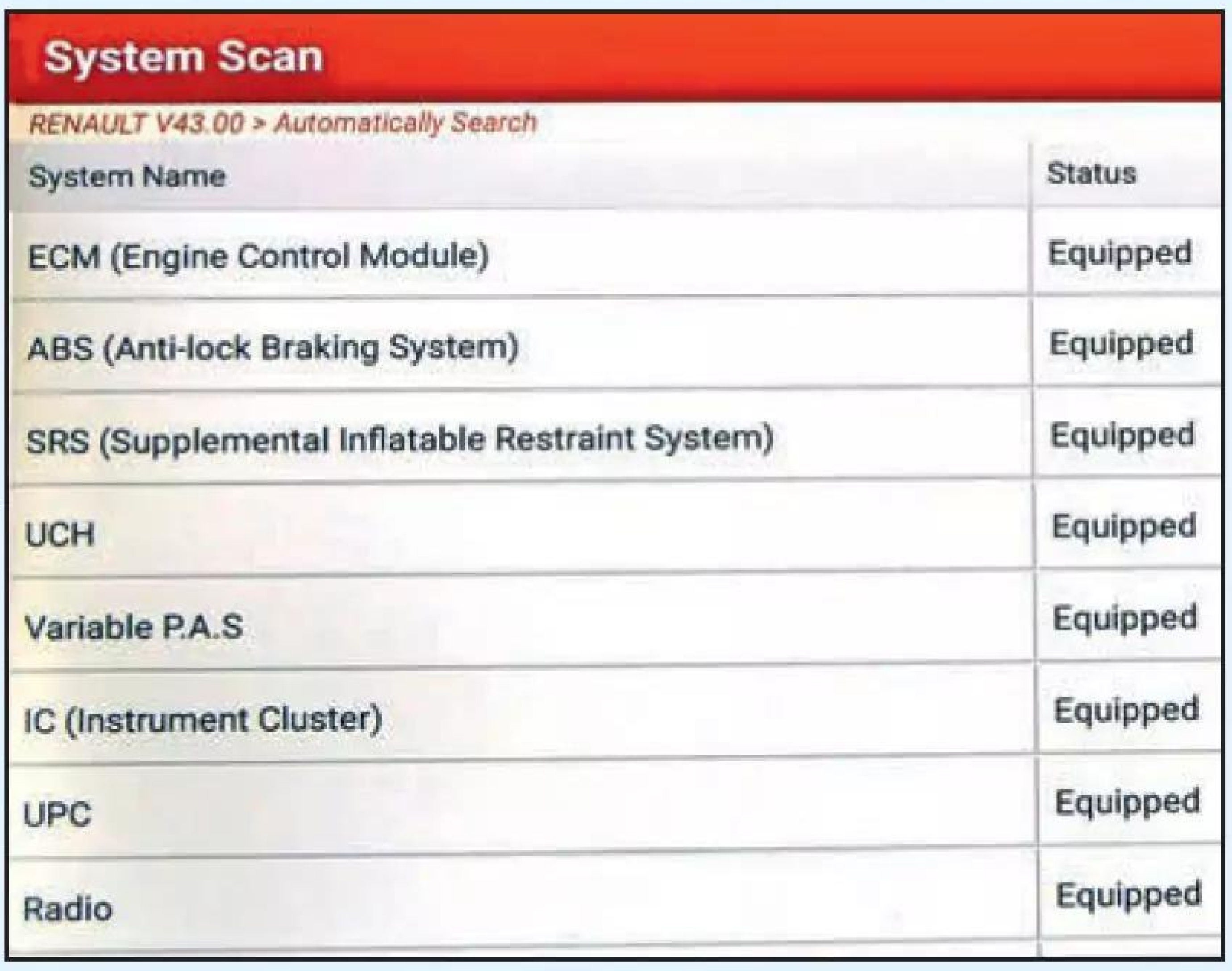
13 ▶ **This is the 'Smart Box' for the Launch X431 Euro Tab II, plugged into the diagnostic socket on the Clio; the socket is located at the base of the facia on the right-hand side of the centre console. The Launch tooling works across a wide range of makes and models.**



Vin Code: VF1BR1[redacted]
Vehicle: CLIO III
After-sales Type: SR0G
Engine Type: K9K
Gearbox Type: JH3
Vin Code: VF1BR1[redacted]
Vehicle: CLIO III
After-sales Type: BR0F
Engine Type: K9K/K7M
Gearbox Type: JA5/JR5

14 ◀ **When plugged in to the diagnostic socket, the Launch unit connects and conducts an 'auto search' for the model, in this case producing a screen shot giving information such as the VIN code, plus engine and gearbox types. This applies to Renault and many other vehicles, but not all makes/models.**

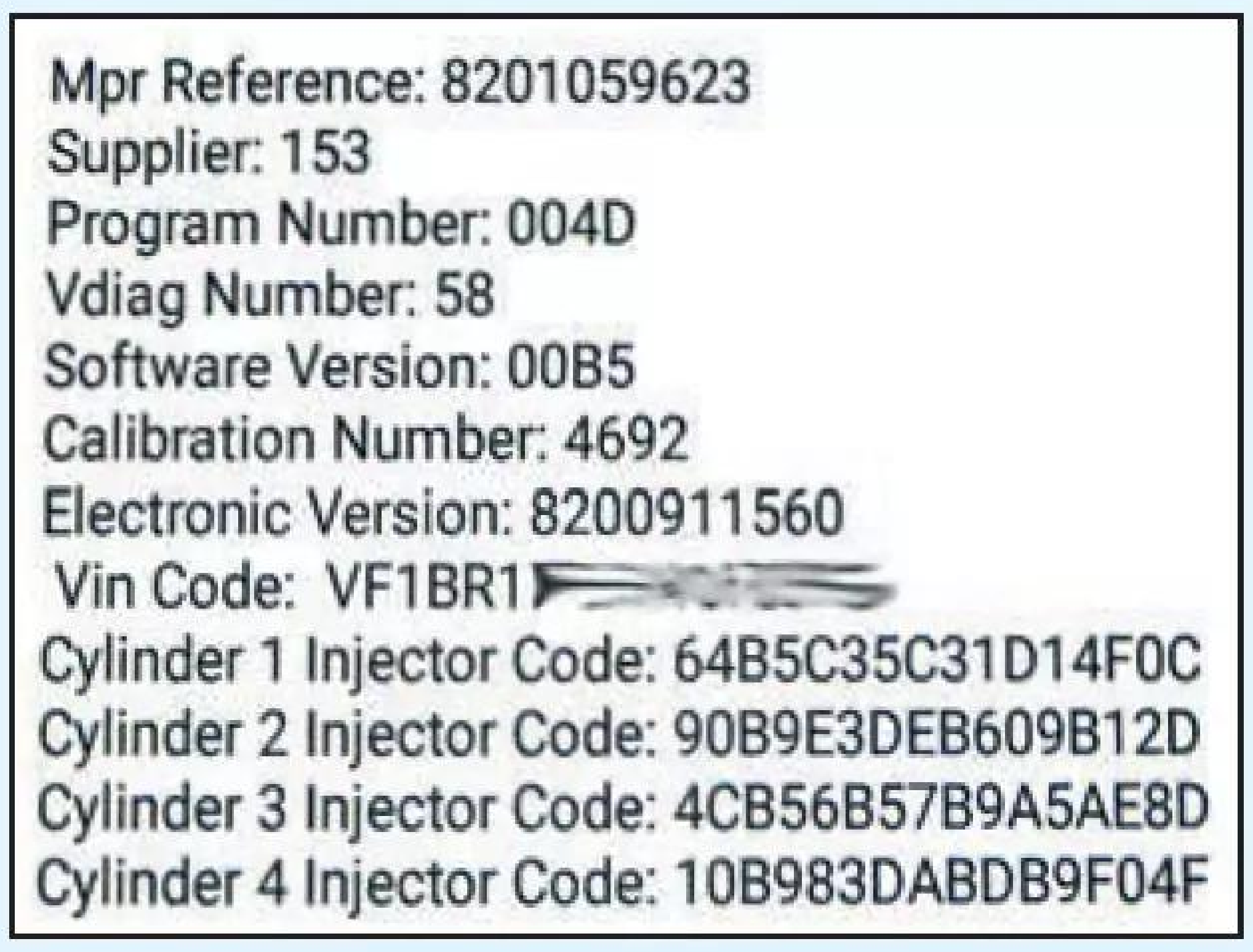
15 ▶ **By means of a full system scan, the Launch diagnostic equipment provides the operator with an overall 'health check' view identifying all the computers installed around the vehicle, so that each can then be diagnostically interrogated individually.**



System Scan

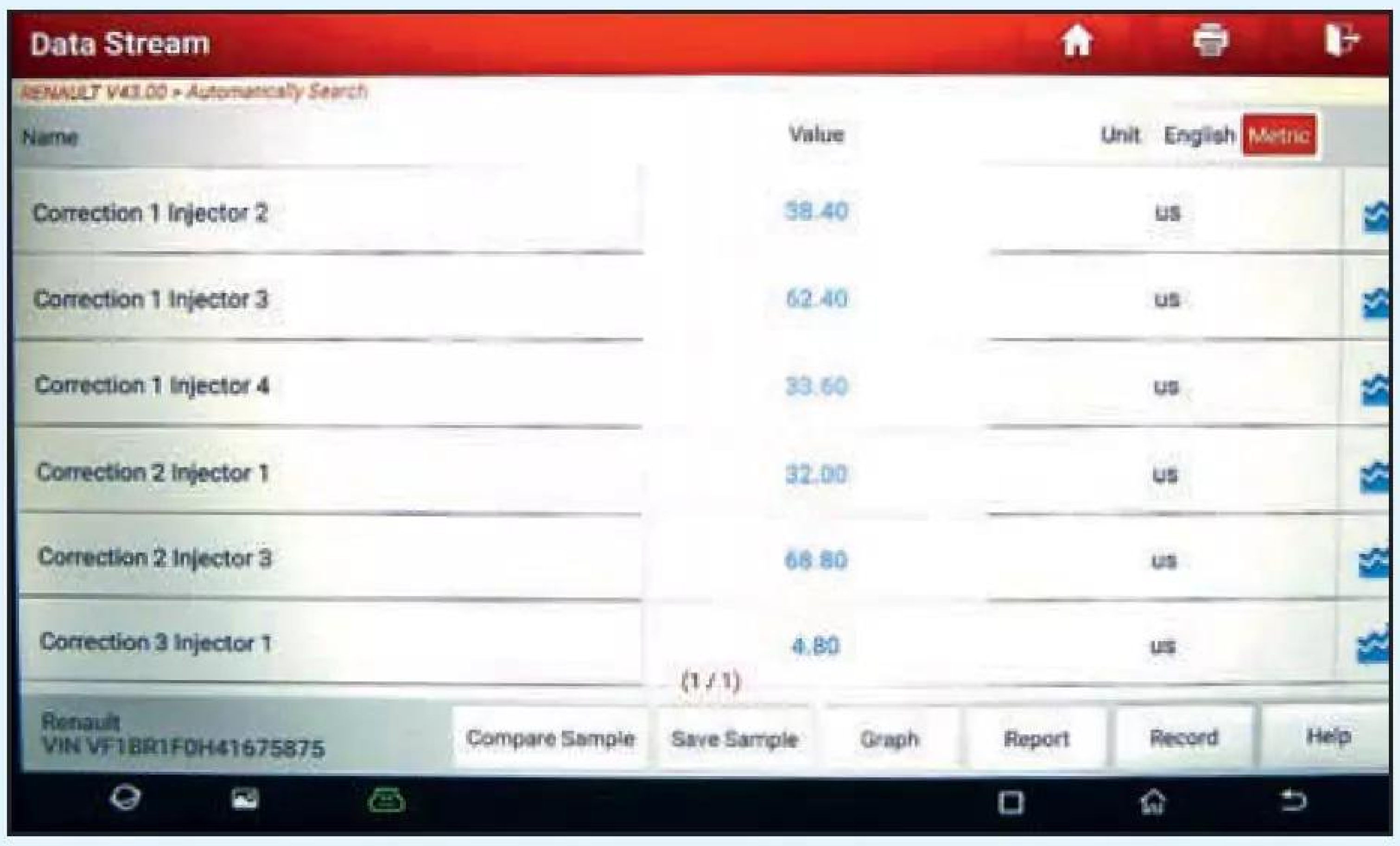
RENAULT V43.00 > Automatically Search

System Name	Status
ECM (Engine Control Module)	Equipped
ABS (Anti-lock Braking System)	Equipped
SRS (Supplemental Inflatable Restraint System)	Equipped
UCH	Equipped
Variable P.A.S	Equipped
IC (Instrument Cluster)	Equipped
UPC	Equipped
Radio	Equipped



Mpr Reference: 8201059623
Supplier: 153
Program Number: 004D
Vdiag Number: 58
Software Version: 00B5
Calibration Number: 4692
Electronic Version: 8200911560
Vin Code: VF1BR1[redacted]
Cylinder 1 Injector Code: 64B5C35C31D14F0C
Cylinder 2 Injector Code: 90B9E3DEB609B12D
Cylinder 3 Injector Code: 4CB56B57B9A5AE8D
Cylinder 4 Injector Code: 10B983DABDB9F04F

16 **The Launch communicates directly with the ECU, so that the operator can control/switch individual systems and components, using the tool. This screen-shot shows data relating to the Clio's body control unit (UCH in Renault terminology).**



Data Stream

RENAULT V43.00 > Automatically Search

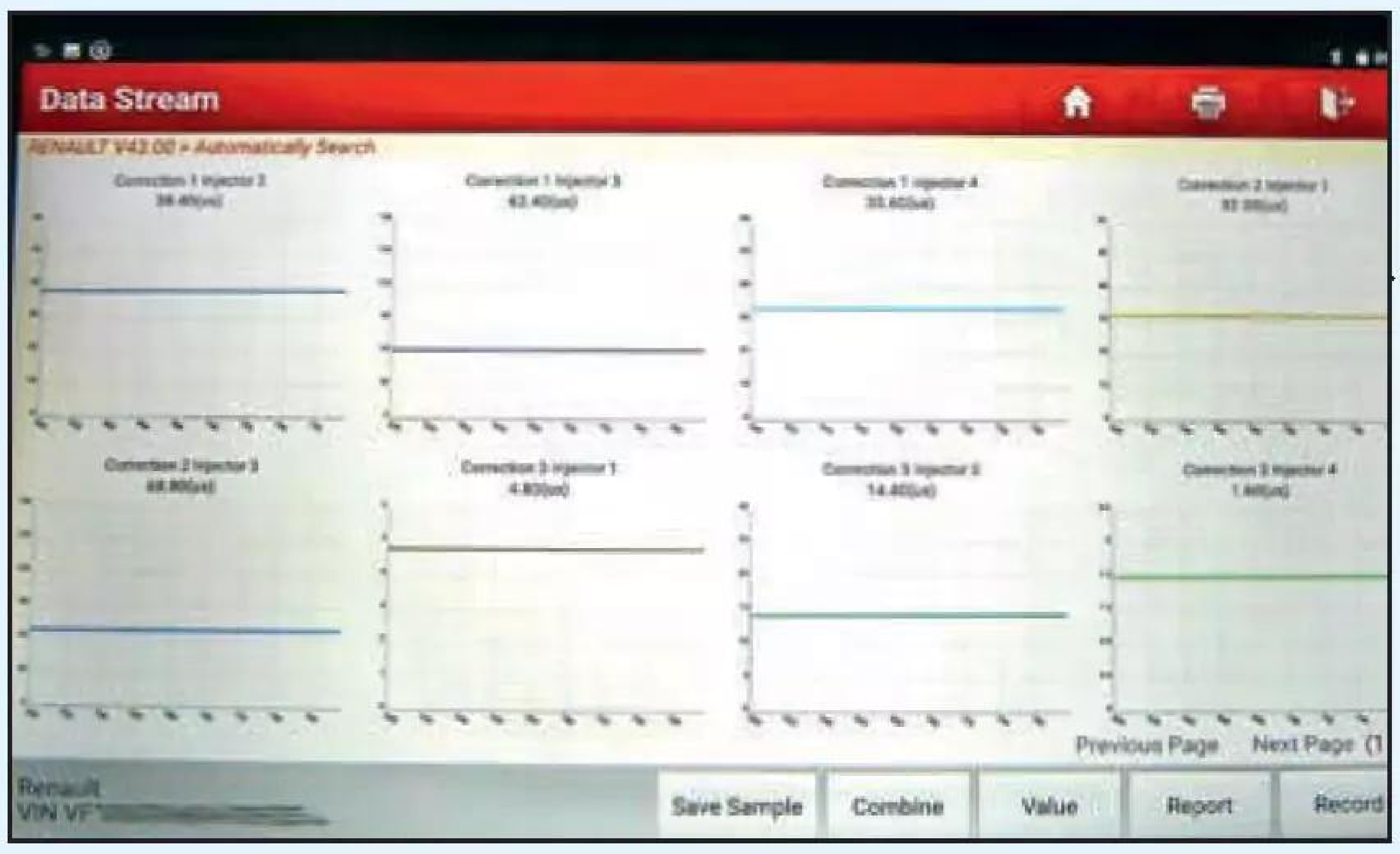
Name	Value	Unit
Correction 1 Injector 2	38.40	us
Correction 1 Injector 3	62.40	us
Correction 1 Injector 4	33.60	us
Correction 2 Injector 1	32.00	us
Correction 2 Injector 3	68.80	us
Correction 3 Injector 1	4.80	us

(1 / 1)

Renault
VIN VF1BR1F0H41675875

English
Metric
Compare Sample
Save Sample
Graph
Report
Record
Help

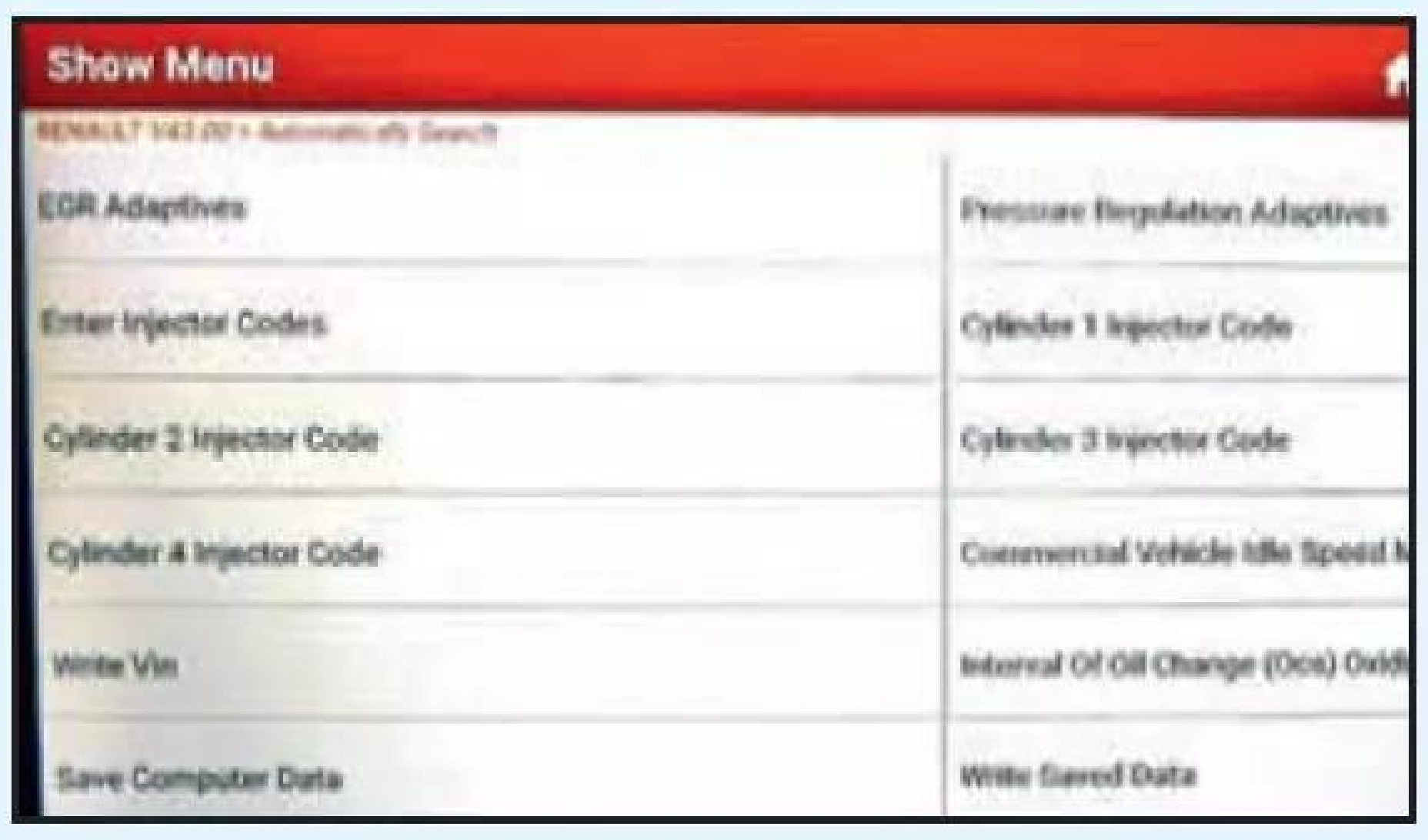
17 ◀ **This Clio is still fitted with its original fuel injectors, but the Launch tool can be used to identify and programme/code new injectors to the vehicle, if ever they need to be renewed. This is a data stream screenshot relating to injector performance…**



Data Stream
RENAULT V43.00 > Automatically Search
Previous Page
Next Page (1
Renault
VIN VF[redacted]
Save Sample
Combine
Value
Report
Record

18 ◀ **…and this screen view is highlighting the same injector fuel flow rates in bar graph format. This enables the operator to see at a glance if all the injectors are working at the same level, and identifying any problem areas. The operator can save this information and return to it later.**

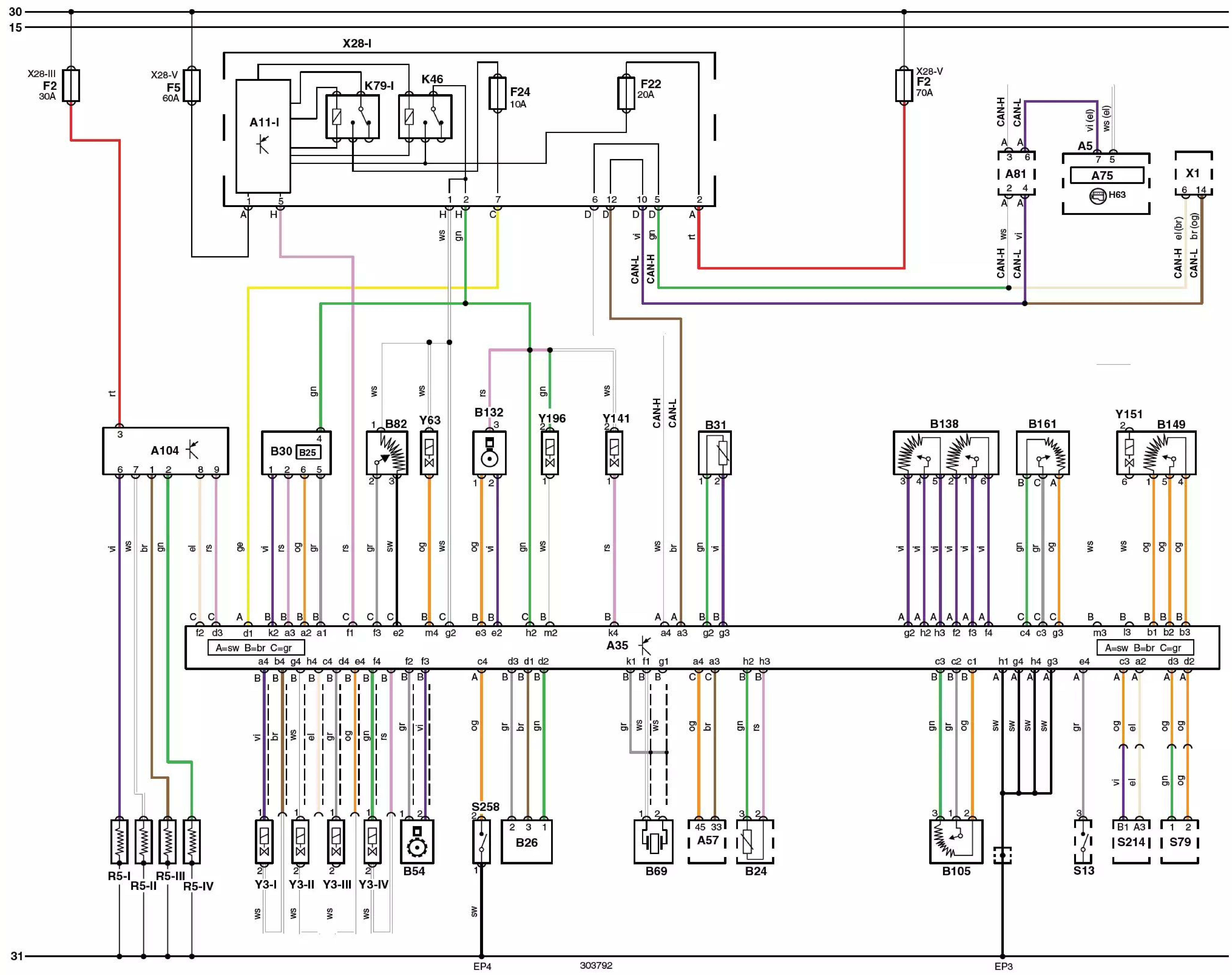
19 ▶ **The Launch equipment incorporates the facility to display a 'special functions' screen, from which the operator is able to re-programme components if required. These functions can be useful if, for instance, you renew the battery and it needs recoding, or the DPF filter needs regenerating, etc.**



Show Menu
EGR Adaptives
Pressure Regulation Adaptives
Enter Injector Codes
Cylinder 1 Injector Code
Cylinder 2 Injector Code
Cylinder 3 Injector Code
Cylinder 4 Injector Code
Commercial Vehicle Idle Speed M
Write Vin
Interval Of Oil Change (Ocs) Odd
Save Computer Data
Write Saved Data

RENAULT CLIO CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
31
X28-I
X28-III
F2
30A
X28-V
F5
60A
A11-I
K79-I
K46
F24
10A
F22
20A
X28-V
F2
70A
CAN-H
CAN-L
A81
A5
A75
H63
X1
A104
B30
B25
B82
Y63
B132
Y196
Y141
B31
B138
B161
Y151
B149
A35
A=sw B=br C=gr
R5-I
R5-II
R5-III
R5-IV
Y3-I
Y3-II
Y3-III
Y3-IV
B54
S258
B26
B69
A57
B24
B105
S13
S214
S79
EP4
303792
EP3

CODE	COMPONENT DESCRIPTION
A5	INSTRUMENT PANEL
A11-I	MULTI-FUNCTION CONTROL MODULE | 1
A35	ENGINE CONTROL MODULE (ECM)
A57	TRANSMISSION CONTROL MODULE (TCM)
A75	INSTRUMENTATION CONTROL MODULE
A81	POWER STEERING CONTROL MODULE
A104	GLOW PLUG CONTROL MODULE
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B26	FUEL SYSTEM PRESSURE SENSOR
B30	MASS AIR FLOW (MAF) SENSOR
B31	FUEL TEMPERATURE SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B69	KNOCK SENSOR (KS)
B82	FUEL/WATER SEPARATOR SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR

CODE	COMPONENT DESCRIPTION
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B149	EXHAUST GAS RECIRCULATION (EGR) VALVE POSITION SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
EP	EARTH POINT
F	FUSE
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
K46	ENGINE CONTROL (EC) RELAY
K79-I	IGNITION MAIN CIRCUITS RELAY | 1
R5-I	GLOW PLUG | 1
R5-II	GLOW PLUG | 2
R5-III	GLOW PLUG | 3
R5-IV	GLOW PLUG | 4
S13	BRAKE PEDAL POSITION (BPP) SWITCH

CODE	COMPONENT DESCRIPTION
S79	CRUISE CONTROL MASTER SWITCH
S214	CRUISE CONTROL REVERSING SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
X1	DATA LINK CONNECTOR (DLC)
X28-I	FUSEBOX/RELAY PLATE, ENGINE BAY
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y141	EXHAUST GAS CONTROL SOLENOID
Y151	EXHAUST GAS RECIRCULATION (EGR) VALVE ACTUATOR
Y196	TURBOCHARGER (TC) CONTROL SOLENOID
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

PEUGEOT 107 1.0 PETROL

Tracing and fixing faults in electronic engine management systems

Peugeot's diminutive 107, powered by a triple-cylinder engine, can make a great deal of sense in terms of low-cost road tax and fuel consumption. **Kim Henson** and **Edward Haggar** take a look at the car's diagnostic prospects.

Introduced in the summer of 2005, the four-seater Peugeot 107 city car was developed in conjunction with near-identical badge-engineered vehicles from Citroën (C1) and Toyota (Aygo). The compact newcomer was offered with three or five doors, and power unit choices were between a three-cylinder 1.0-litre petrol engine and a four-cylinder 1.4-litre HDi diesel.

A raft of cosmetic and engineering changes in 2009 resulted in mild restyling, interior upgrades and slightly lower engine emissions, plus marginally improved fuel consumption. The 108 arrived in 2014, ousting the 107.

The 107 featured here is owned by the editor and was registered in November 2007. It's powered by the 998cc petrol unit. Our diagnostic guide to this 107 and its Bosch Motronic ME7.9.5 management system is Edward Haggar.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Preparation

As far as repairs and servicing goes these 107s have got to be among the easiest modern cars to work on. Even a clutch change can be carried out by a home mechanic. The engine is fitted with a timing chain, so there are no routine belt changes to consider.

These engines are very reliable. Edward says that he has a customer whose 107 has so far covered 165,000 miles and still on its original engine internals. The owners allow him to change the engine oil every five months or 5000 miles (whichever comes first) to maintain reliability.

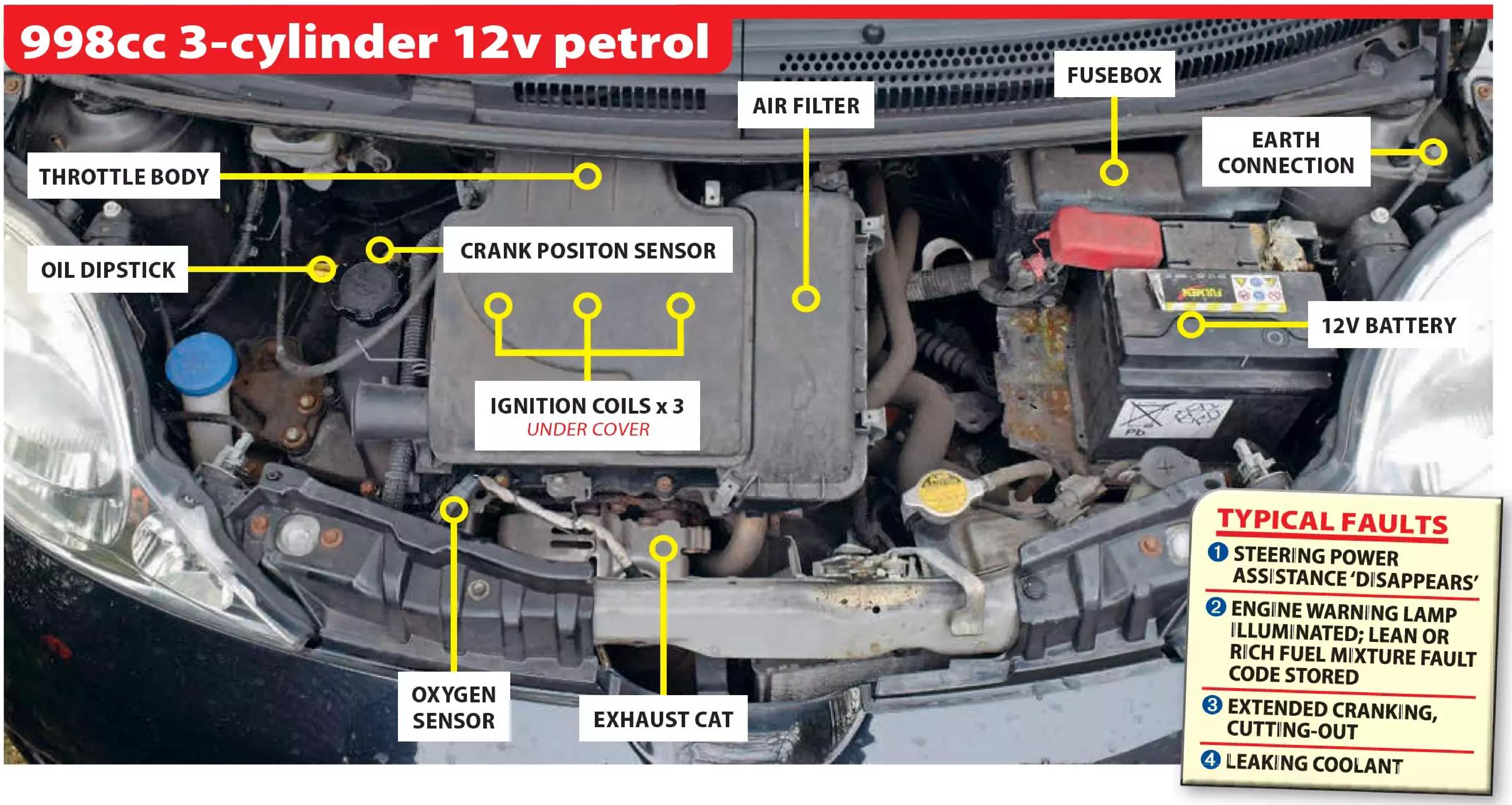
Edward advises that the trick with these diminutive motors is to keep on top of things – and, of course, regular maintenance is a big help.

Fault 1:

STEERING SYSTEM ECU FAILURE

This fault can be scary in the way it arrives... The driver can be driving along normally then suddenly, and without prior warning, the steering system's

998cc 3-cylinder 12v petrol



TYPICAL FAULTS

1. STEERING POWER ASSISTANCE 'DISAPPEARS'
2. ENGINE WARNING LAMP ILLUMINATED; LEAN OR RICH FUEL MIXTURE FAULT CODE STORED
3. EXTENDED CRANKING, CUTTING-OUT
4. LEAKING COOLANT

⇨

Tool of choice

▶ The Launch X431 Euro Tab II tool is just the job for in-depth diagnostic interrogation of this little Peugeot. The equipment is able to identify the actual vehicle under review and its main drivetrain components.

In addition, the tool can be used to show a multitude of different invaluable screenshots, including (for example) those displaying system components/computers present around the vehicle, live data and many other aspects.

The Launch equipment can easily and rapidly be set up by the operator to control/operate individual systems and components remotely (by Bluetooth). The Launch tool can also be used for a wide variety of other makes and models.

power assistance is lost. To someone who's not used to a 'pre-power steering' car with no power assistance, this can be scary. The fault will be accompanied by a steering system warning light on the dash. In the early stages of this fault occurring you may simply be able to cycle the ignition and the light will clear and the steering returns to normal, but be warned that the fault will return and catch you out again.

A simple diagnostic check will show 'C1554 power steering malfunction'. The problem lies internally within the steering ECU, which is located above the pedals. You can opt for a new ECU – but this route is expensive and coding is required. By contrast, Edward uses an ECU repair company that provides a quick repair turnaround and this option is a simple plug-and-play fix, which also comes with a lifetime guarantee.

Fault 2:

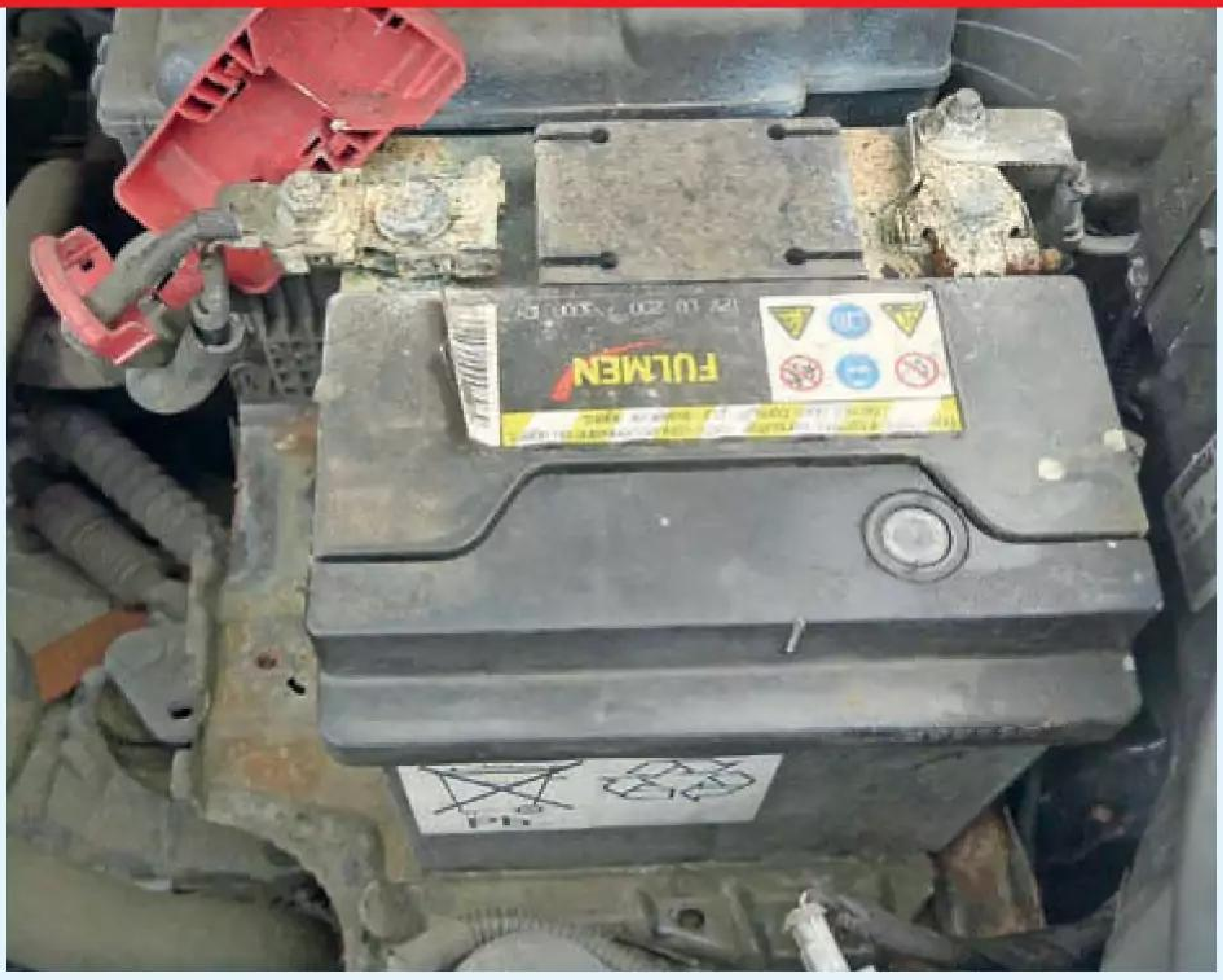
DODGY MAP SENSOR

Manifold absolute pressure (MAP) sensor problems can become evident in several ways. Firstly, and most commonly, you may have an engine warning light illuminated, with a lean or rich fuel mixture fault code stored, and possibly a MAP sensor fault code.

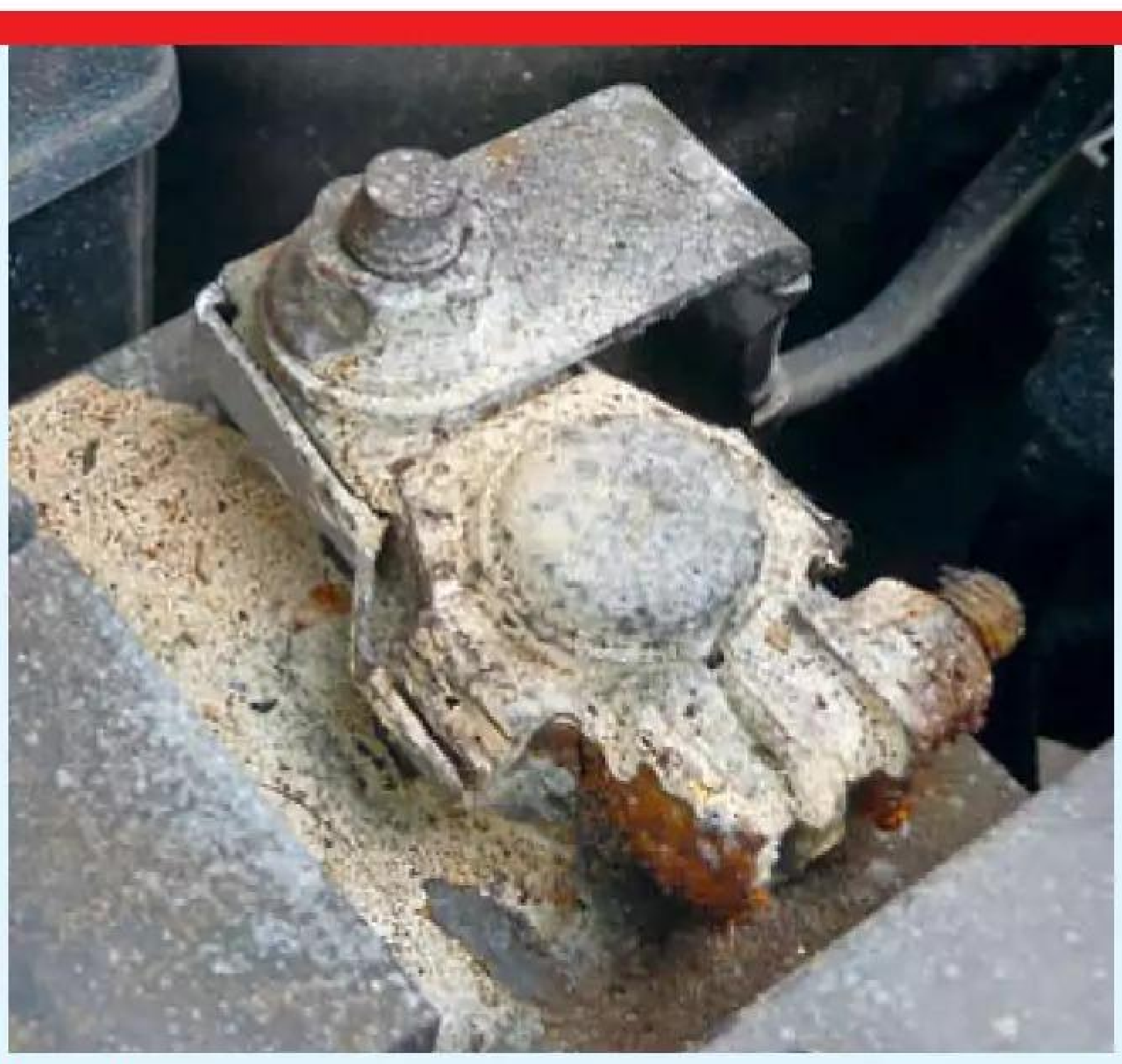
It's worth noting here that the lean or rich codes could be stored due to air leaks or restrictions. A smoke test of the intake system is a useful quick check here; if that's all okay then carry out testing on the MAP sensor.

It's worth looking at live data for the MAP sensor. In key-on mode, in theory

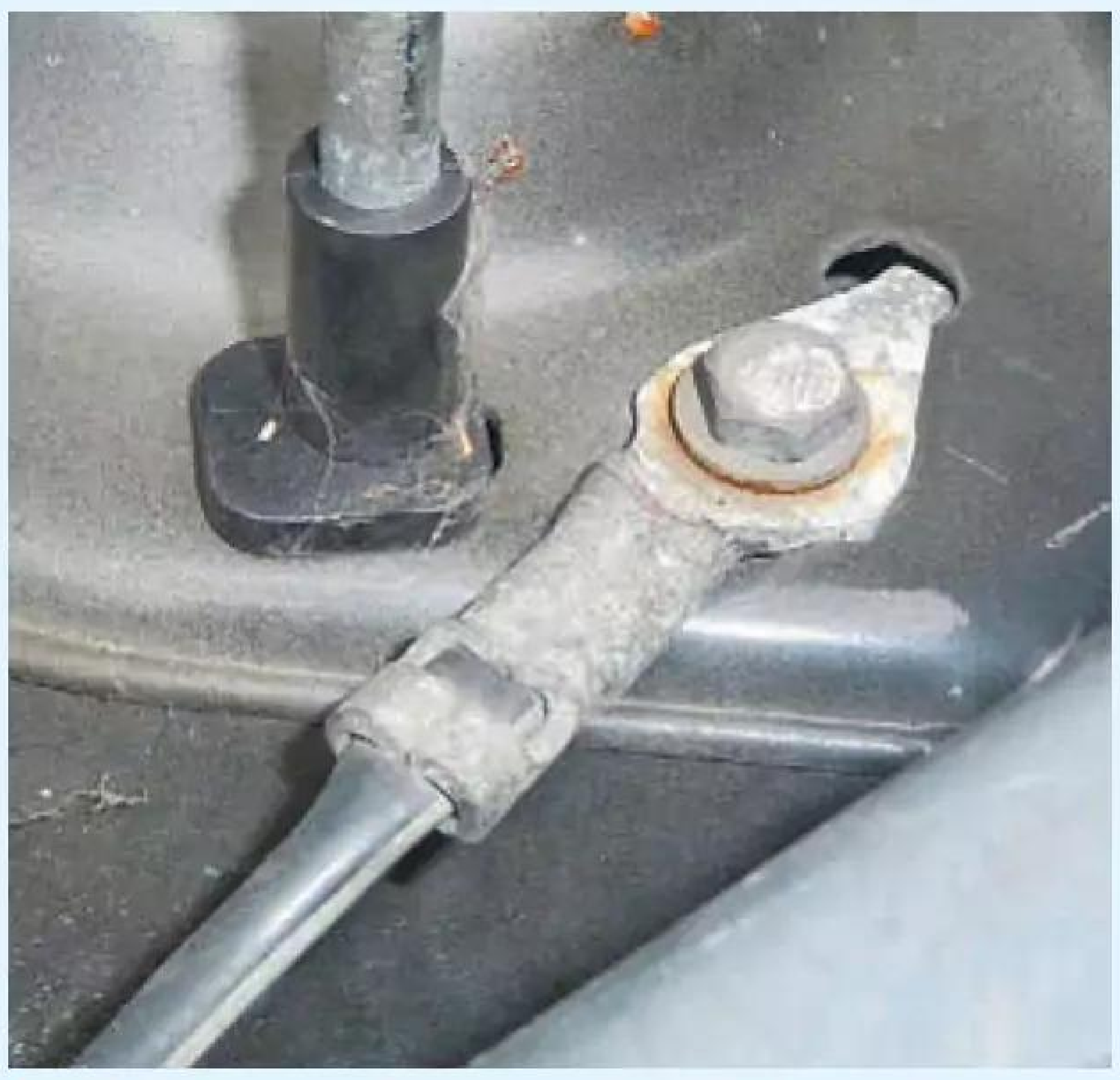
Typical Peugeot 107 components



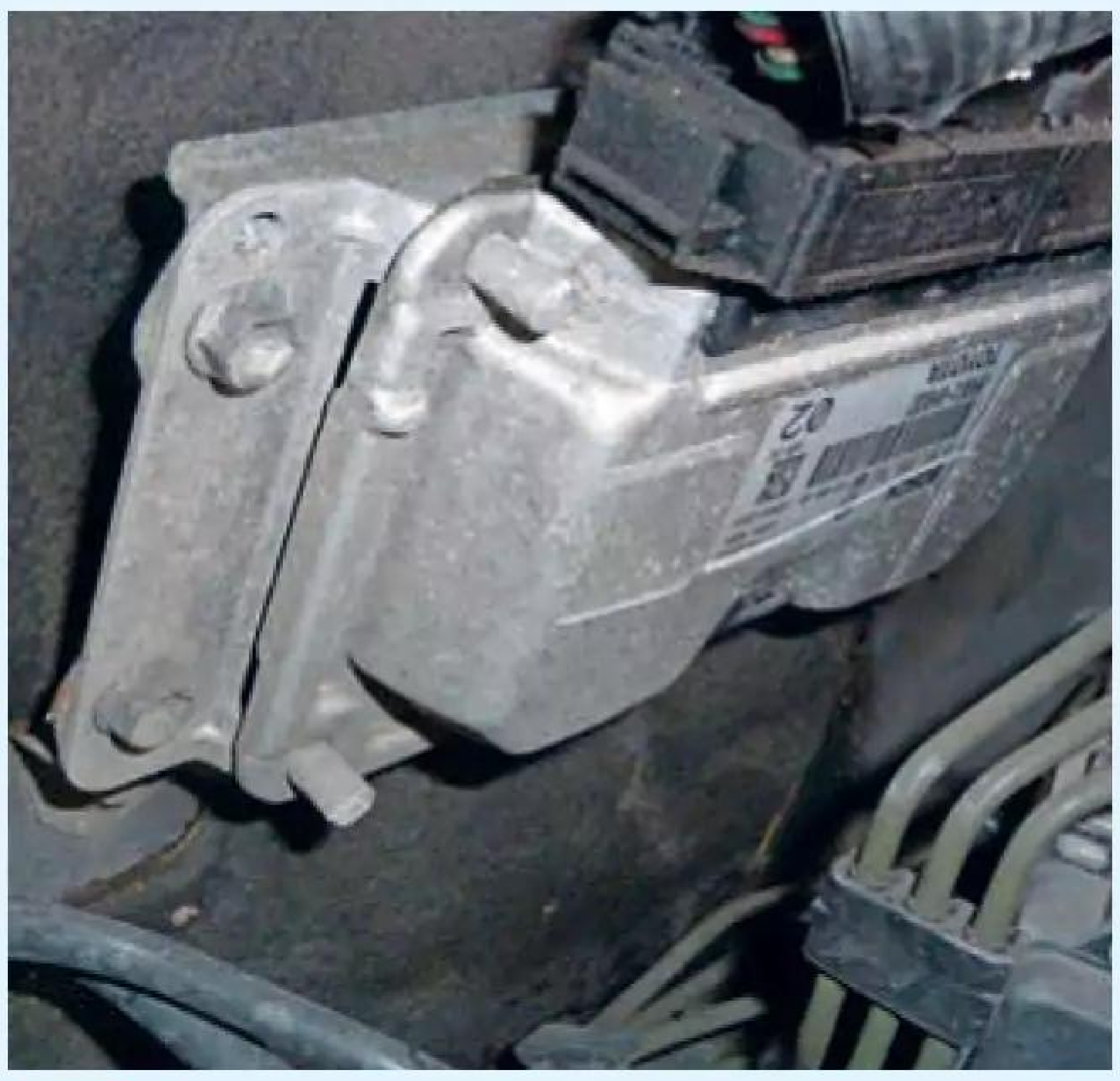
1 ◀ **On the left side of the engine bay the 12V battery is housed. It's easy to reach, sitting just behind the headlamp and inboard of the front suspension tower. Check the battery for security, cleanliness and sound connections. Fulmen batteries were used as OE equipment, so this is probably the original. Fulmen is now in the hands of Exide Technologies.**



2 The negative (earth or ground) battery terminal connector is fairly substantial but can still suffer from the effects of airborne moisture, eventually resulting in corrosion. Clean the connection, applying protectant to keep the elements at bay.



3 The earth/ground cable from the battery is earthed on to the left-hand front suspension tower. Ensure that the cable is in good condition and that the connection on to the car's bodywork is firmly attached and clean. If not, dismantle the joint, clean and protect it.



4 Somewhat tucked away towards the rear of the engine compartment is the ECU. Note that the ECU on this 107 is marked 'Toyota'; a result of the collaboration involved in producing these cars. Check for security, damage and moisture ingress.

5 Mounted on the thermostat housing on the left side of the cylinderhead, and almost completely hidden from view and from our probing camera lens, the coolant temperature sensor (CTS) is essential for feeding information to the ECU to help determine fuelling levels.

ENGINE MANAGEMENT

The Bosch Motronic ME7.9.5 management system used on this 107 incorporates these primary components:

- Multiplug ECU.
- 3 x pencil ignition coils.
- 3 x solenoid-type fuel injectors.
- Engine coolant temperature sensor, mounted on cylinder-head.
- Throttle body with fly-by-wire operation.
- Brake pedal position sensor.
- Standard (traditional-type) lead acid battery.
- Pre- and post-catalytic converter oxygen/O2/Lambda sensors.
- Catalytic converter incorporated into exhaust manifold.

the reading should be as close to 0 as possible – anything higher suggests a faulty sensor.

You need to remove the air filter housing – first releasing the two 'squeeze' clips. You should then see the MAP sensor at the back of the throttle body, held by two bolts (10mm). You could just remove and clean it if no diagnostic equipment is available; carefully use a cotton wool bud with a light proprietary cleaning fluid/spray.

If available use a multimeter set to 'voltage' with negative on negative battery post; the positive cable from multimeter back probing pin 1 should read 1.2-2 volts.

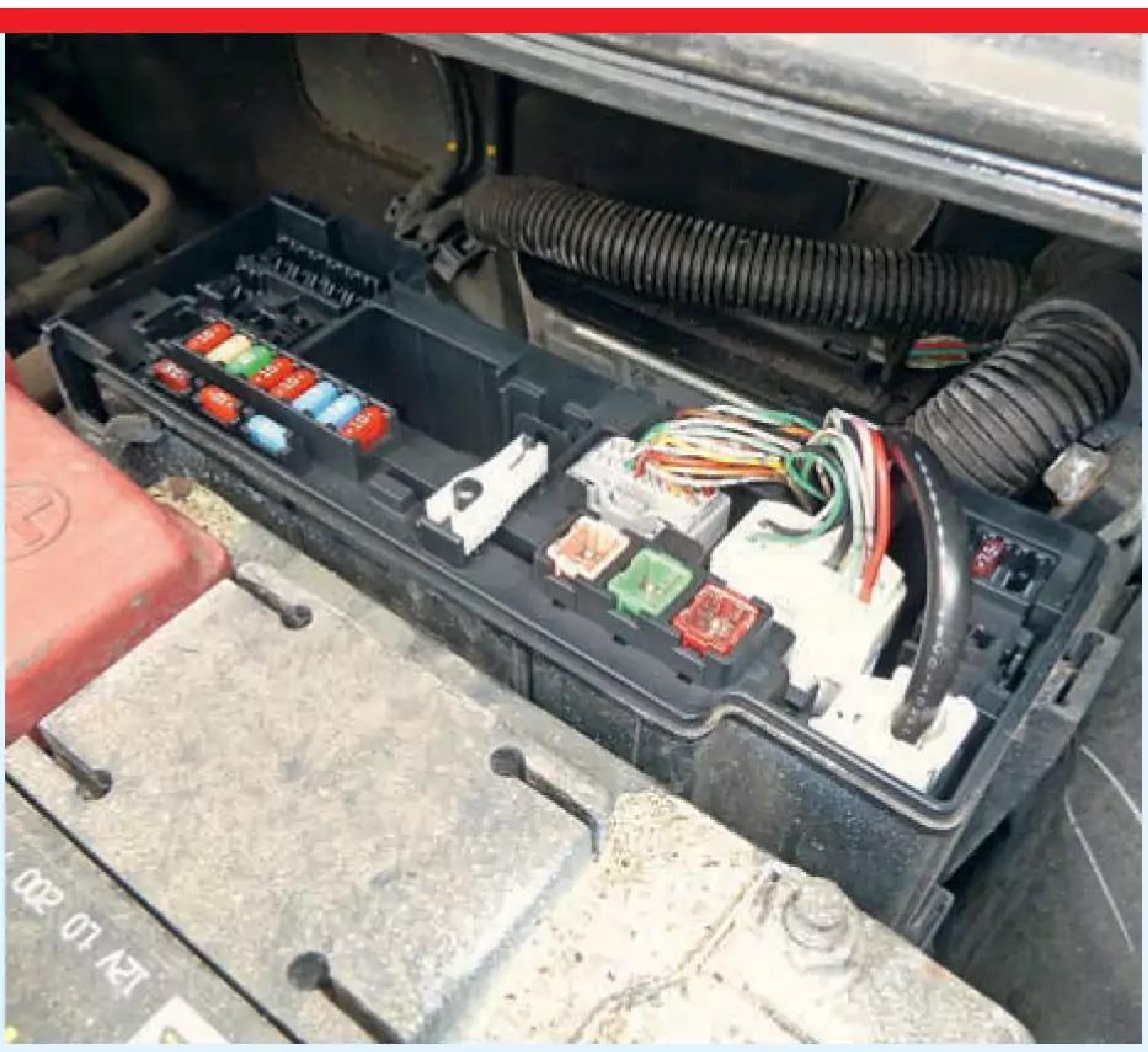
Edward advises always to fit a high-quality replacement for the sensor. Some cheaper, poor-quality items are available, but you would be surprised at the power loss and dip in fuel economy that a poorly performing inferior sensor may bring about. Peugeot do offer parts prices at competitive rates so a call to the main dealer may surprise you…

Fault 3:

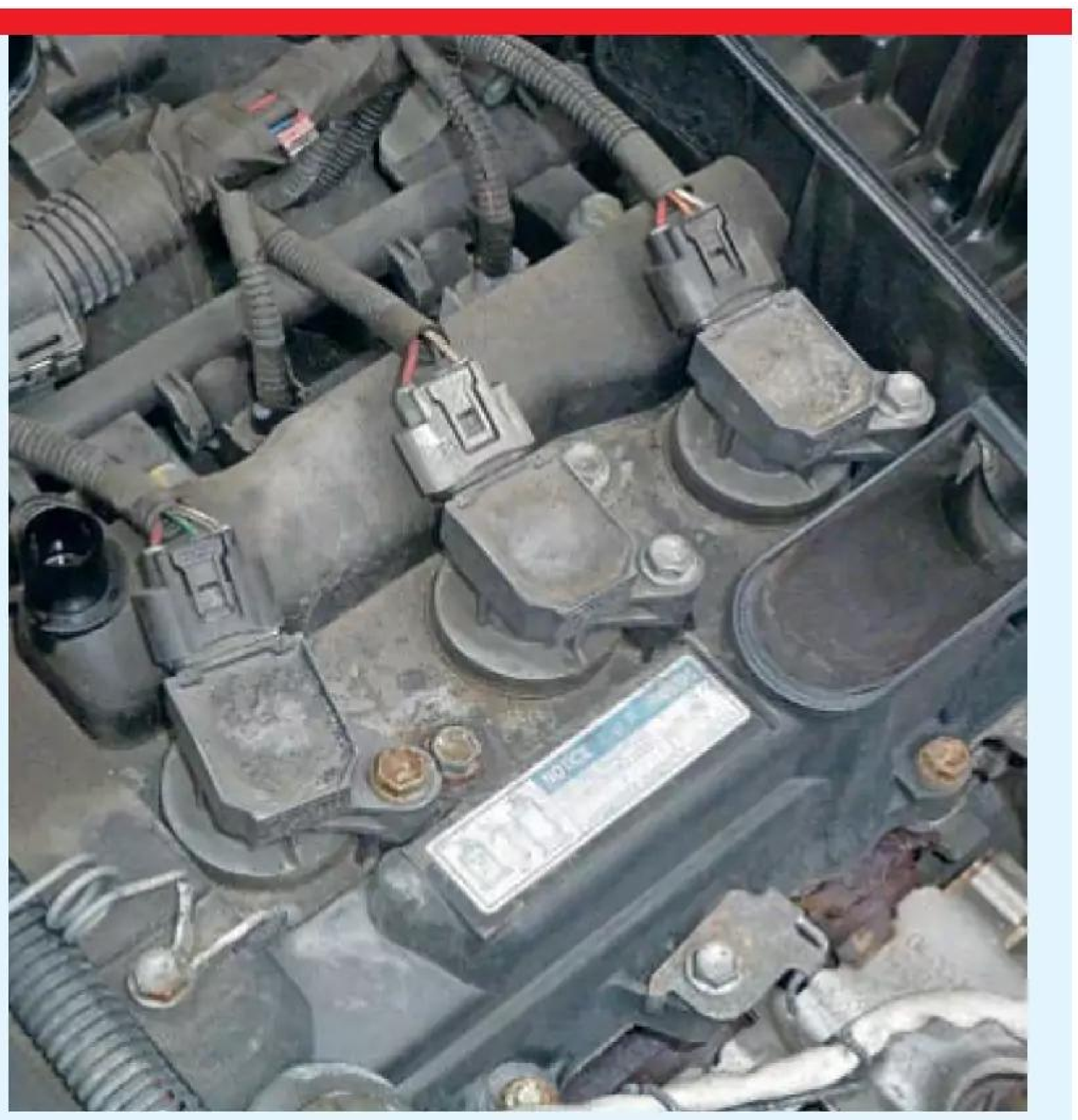
FUEL PUMP PROBLEMS

This fault can show itself in numerous ways: notably the engine may start only after extended cranking, or can cut out when running. The fault lies with the fuel pump – or more importantly – the filter inside it.

First, you could connect an amp clamp to the fuel pump fuse and check current draw to see if the pump is drawing more current than it should be, ie working harder due to being blocked – or it could be caused by a pump fault. Edward says that he likes to connect a fuel pressure



6 **◀ Tucked behind the battery and just inboard of the left-hand front suspension tower, is the underbonnet fuse and relay box, which is normally covered by a protective lid. Make sure that the lid is always correctly and fully fitted, to keep out moisture.**



7 **▶ Three cylinders means three separate ignition coils on this engine (and spark plugs below), all accessibly positioned at the top of the engine, and usually hidden by a plastic cover panel. Ensure that the coils are secure (each held with one 10mm nut), in good physical condition and with sound cables/connections.**

8 **The close-coupled oxygen/O2/Lambda sensor and catalytic converter are positioned right at the front of the engine, and are very easy to reach. The close proximity of the cat to the engine helps it to warm up quickly to effective operating temperature.**

9 **Usually concealed beneath the engine cover, the throttle body assembly is quite accessible once the cover has been removed. Ensure that the throttle body and operating flap are clean, and that the flap moves without sticking.**

10 **This view of the top of the engine illustrates the wiring loom assembly serving the ignition coils and injectors (which are just visible within the hollow at the top of the engine, towards the lower edge of this photo). Check for deterioration.**

gauge under the bonnet to see actual fuel pressures. You're looking for 3.1 to 3.5 bar; anything around 2 bar would show either a blocked filter or an ailing pump.

You can carry out a resistance check on the pump between pins 4 and 5, with your multimeter set to ohms, and you are looking for 0.2-3 ohms. Access is simple. Lift up the rear seats and remove the dust cover; the pump is sat in the fuel tank beneath a screwed-on cover.

If necessary, removal can be achieved using a hammer and screwdriver (applied VERY gently) or better still the special tool is cheap enough to buy online.

In all cases check the rubber seal between pump and tank for splits and correct sealing. Edward advises that he has found success by removing the pump, stripping it down and cleaning it.

Technical Specs

Actual values

Component	Value
Injector resistance	12 ohms
Ignition coil pins 1 and 4	0.3-0.8 ohms
Oxygen sensor heater circuit pins 1 and 2	4-16 ohms
Crank sensor	1850-2450 ohms

It's worth trying this approach before jumping straight to pump replacement. You'll clearly be able to see the gauze filter and any dirt build-up.

Fault 4:
TIME/MILEAGE-EXPIRED WATER PUMP

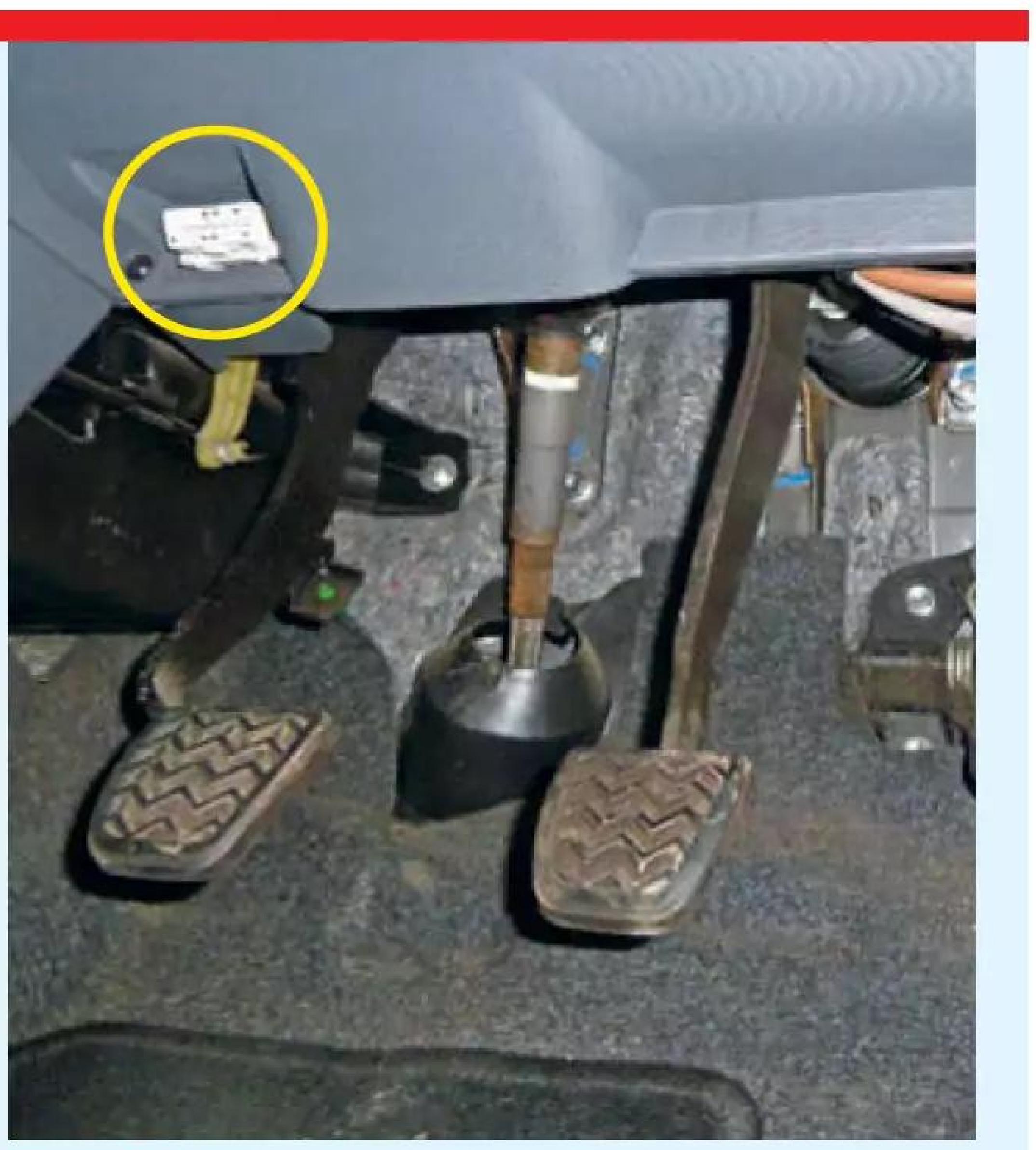
It's not unusual for the coolant/water pump to leak and the bearings to fail. You should regularly check the pump for signs of leaks – it's driven via a belt on the timing chain side of the engine. The belt is adjusted via the alternator, and the water pump is held in via five bolts (12mm spanner size) that need torqueing to 28Nm on re-installation.

Refill the system with four litres of the correct 'pink' (OAT-type) coolant, then run the engine and check for leaks. Ensure that the heater is blowing hot air when the system is set to 'hot', and that the cooling fan kicks in as designed.

Typical Peugeot 107 components

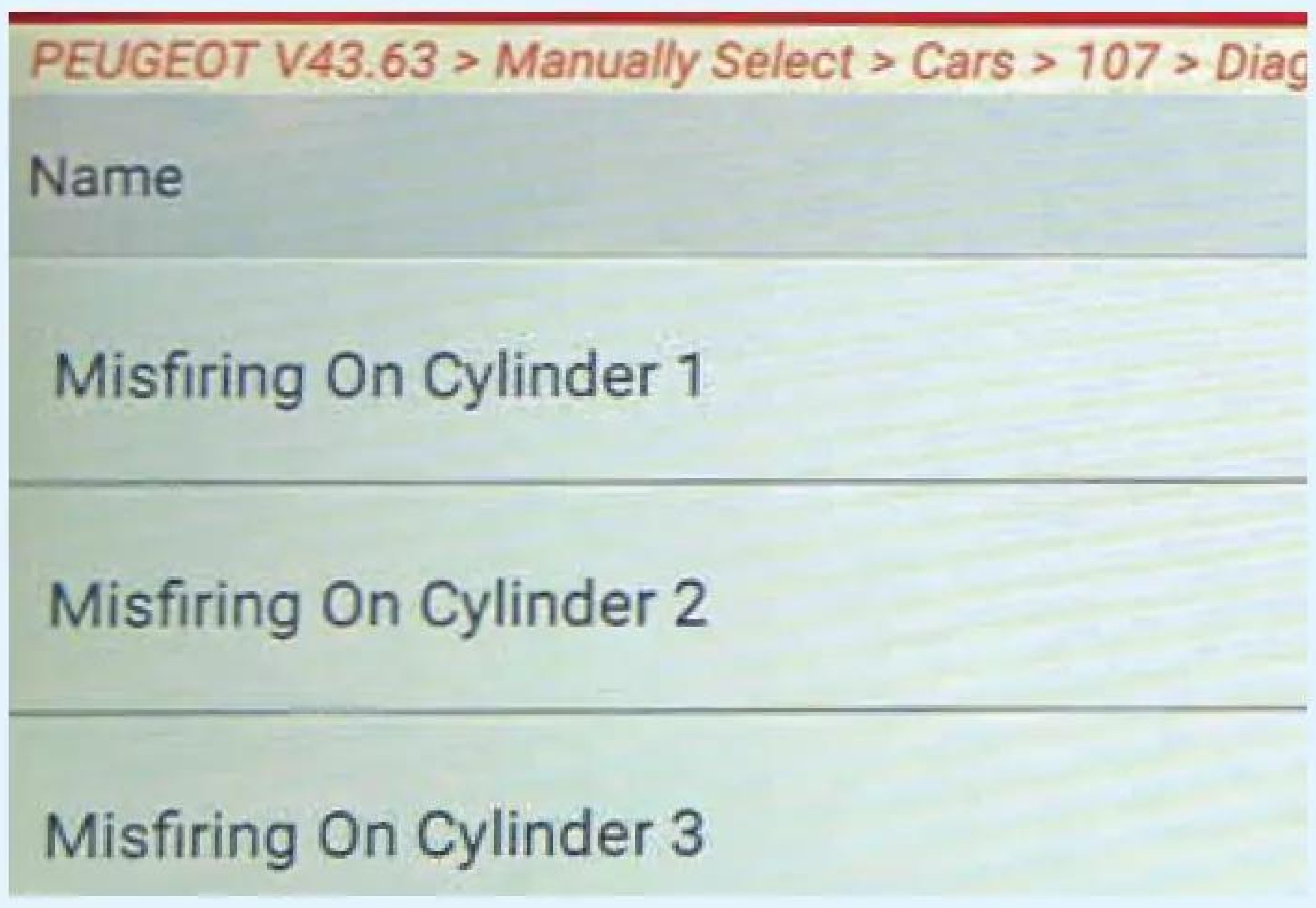
11 The crankshaft position sensor can be challenging to see because it's mounted low down on the engine, towards the rear. However, there was just enough room to get our camera near to the sensor.

12 Hiding towards the rear of the engine bay is the valve/vent solenoid that controls the evaporative emissions control (EVAP) system. If this set-up malfunctions, it can result in excessive emissions as well as below-par performance.



13 The brake and accelerator pedal assemblies incorporate sensors (not visible here) at their upper ends, to communicate with the ECU regarding pedal positions. The diagnostic socket can be seen at the lower edge of the facia (circled).

14 ◀ Beneath the dashboard, on the right-hand side, is a separate ECU serving the steering system. Our photograph shows the ECU as viewed from the right-hand footwell, directly underneath it.



PEUGEOT V43.63 > Manually Select > Cars > 107 > Diag

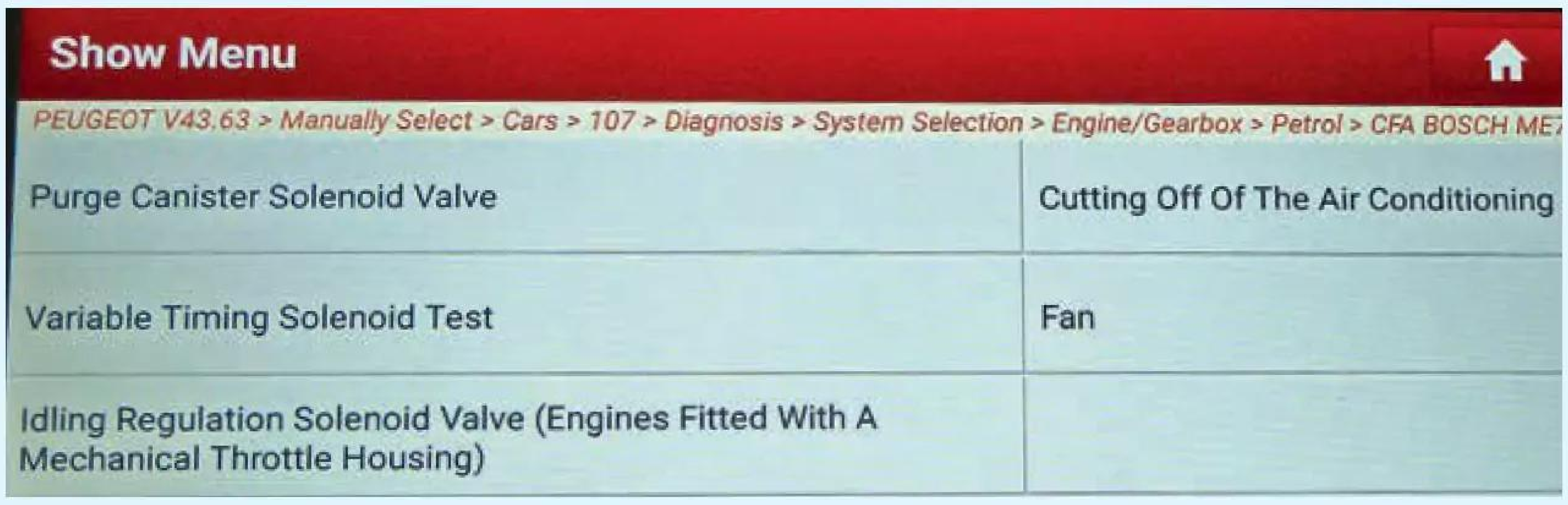
Name

Misfiring On Cylinder 1

Misfiring On Cylinder 2

Misfiring On Cylinder 3

15 ▶ This close-up of a 'live data' screenshot on the Launch tool illustrates that the equipment can monitor and individually identify misfires on each of the 107's three cylinders. This can help the operator save a great deal of time. This car was fine!



Show Menu

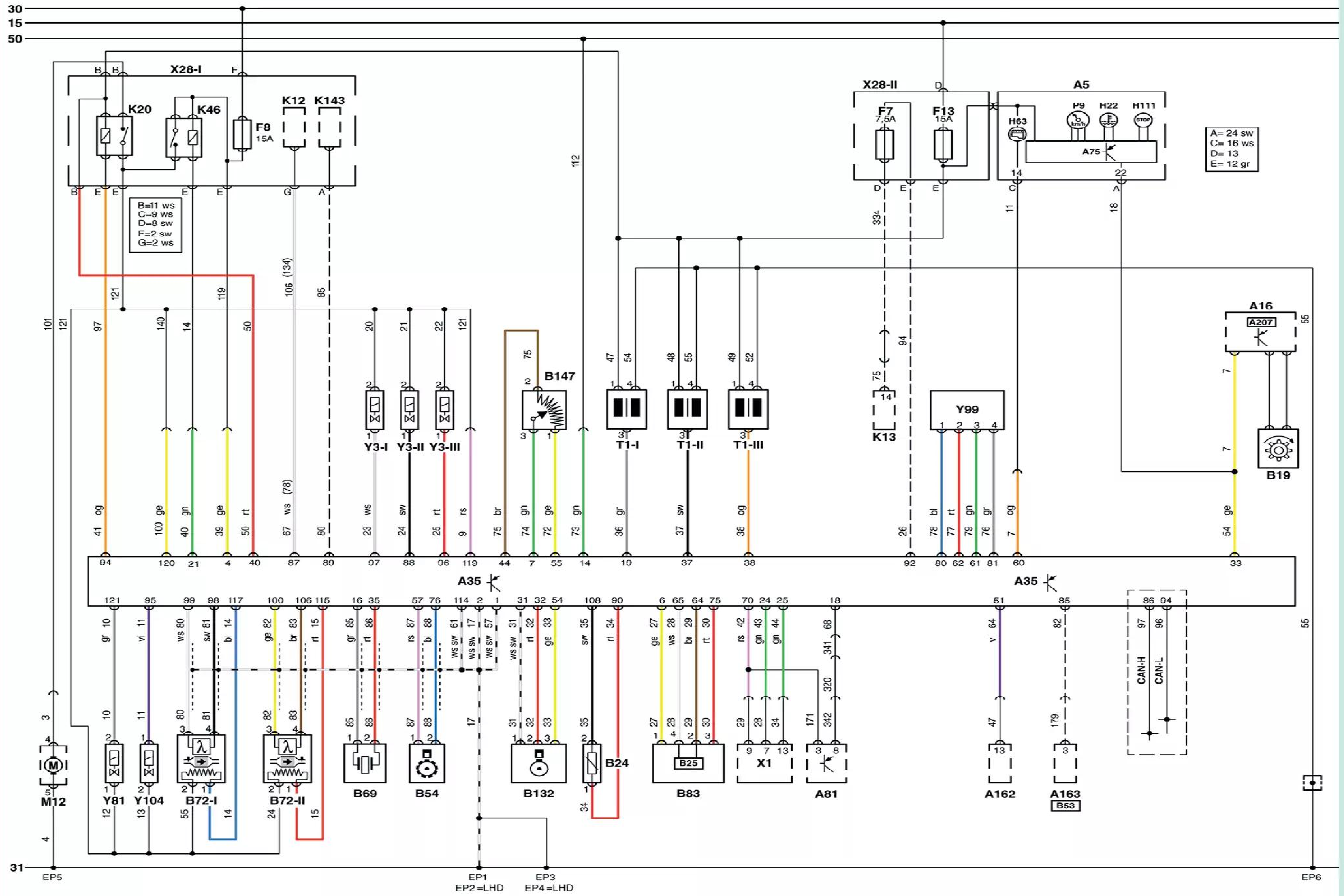
PEUGEOT V43.63 > Manually Select > Cars > 107 > Diagnosis > System Selection > Engine/Gearbox > Petrol > CFA BOSCH ME

Purge Canister Solenoid Valve	Cutting Off Of The Air Conditioning
Variable Timing Solenoid Test	Fan
Idling Regulation Solenoid Valve (Engines Fitted With A Mechanical Throttle Housing)	

16 ◀ The Launch equipment is ideal for running tests on all the different functions of the management system ECU, and enables the operator to actuate each system in turn, which helps to identify/pinpoint problem areas. Edward used the Launch equipment to operate/control the various electrical circuits around the vehicle. This work can be carried out at some distance from the car, if required. A very useful function of the Launch tool is the wireless connection, enabling the operator to work remotely to monitor data.

BOSCH MOTRONIC ME7.8.5 CIRCUIT DIAGRAM

Autodata
www.autodata-group.com


30
15
50
X28-I
K20
K46
F8 15A
K12
K143
B=11 ws
C=9 ws
D=8 sw
F=2 sw
G=2 ws
X28-II
F7 7,5A
F13 15A
A5
H63
P9
H22
H111
A75
A= 24 sw
C= 16 ws
D= 13
E= 12 gr
B147
Y3-I
Y3-II
Y3-III
T1-I
T1-II
T1-III
K13
Y99
A16
A207
B19
A35
M12
Y81
Y104
B72-I
B72-II
B69
B54
B132
B24
B25
B83
X1
A81
A162
A163
B53
CAN-H
CAN-L
31
EP5
EP1
EP2 =LHD
EP3
EP4 =LHD
EP6

CODE	COMPONENT DESCRIPTION
A16	ABS CONTROL MODULE
B19	ABS WHEEL SPEED SENSOR, LEFT FRONT
K143	AC COMPRESSOR CLUTCH RELAY
A163	AC COMPRESSOR CONTROL MODULE
B53	AC EVAPORATOR TEMPERATURE SENSOR
30	BATTERY +
31	BATTERY -
Y81	CAMSHAFT POSITION (CMP) ACTUATOR
B132	CAMSHAFT POSITION (CMP) SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
B54	CRANKSHAFT POSITION (CKP) SENSOR
X1	DATA LINK CONNECTOR (DLC)
A207	ELECTRONIC STABILITY PROGRAM (ESP) CONTROL MODULE
A35	ENGINE CONTROL MODULE (ECM)
K46	ENGINE CONTROL RELAY
H22	ENGINE COOLANT 'HOT' WARNING LAMP
K12	ENGINE COOLANT BLOWER MOTOR RELAY
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
H63	ENGINE MALFUNCTION INDICATOR LAMP (MIL)
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
M12	FUEL PUMP
K20	FUEL PUMP RELAY
X28-I	FUSEBOX/RELAY PLATE | **1**
X28-II	FUSEBOX/RELAY PLATE | **2**
B72-I	HEATED OXYGEN SENSOR (HO2S) | **1**
B72-II	HEATED OXYGEN SENSOR (HO2S) | **2**
K13	HEATED REAR WINDOW RELAY
Y99	IDLE AIR CONTROL (IAC) VALVE
T1-I	IGNITION COIL **1**
T1-II	IGNITION COIL **2**
T1-III	IGNITION COIL **3**
15	IGNITION SWITCH - IGNITION ON
50	IGNITION SWITCH - START SIGNAL
A162	IMMOBILISER CONTROL MODULE
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
A75	INSTRUMENTATION CONTROL MODULE
A5	INSTRUMENT PANEL
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B69	KNOCK SENSOR (KS)
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
A81	POWER STEERING CONTROL MODULE
H111	STOP ENGINE WARNING LAMP
B147	THROTTLE POSITION (TP) SENSOR
P9	VEHICLE SPEEDOMETER

NOTE: IN CERTAIN DIAGRAMS (CITROËN, PEUGEOT & RENAULT) COLOUR CODES ARE REPLACED BY NUMBERS, WHICH ARE USED TO IDENTIFY A PARTICULAR CABLE AND NOT THE COLOUR. IN THIS INSTANCE, THE CABLES WILL BE NUMBERED AT EACH END CLOSE TO THE HARNESS CONNECTOR.

Electronic Diagnostics

SUZUKI CELERIO 1.0 PETROL

Tracing and fixing faults in electronic engine management systems

Suzuki's Celerio arrived in 2015 and has been hailed as an affordable, economical and reliable small car. **Kim Henson** and **Edward Haggar** take a look at its electronic management system.

NOTE: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Suzuki has been producing effective, economical and durable small engines for many years, with valuable experience gained from the firm's motorcycles – also cars such as the three-cylinder Alto of the mid-1980s.

The Celerio is powered by a 998cc three-cylinder K10B engine, or, for higher-specification versions, the K10C 'Dualjet' motor. The K10B engine is a very efficient unit. When launched, it came with a 99g/km CO2 rating and an official combined mpg figure of 65.7 – though the K10C is better still. It features a higher compression ratio (12.0:1 rather than 11.0:1), plus friction reduction technology, with variable valve timing too. In addition, it incorporates a cooled exhaust gas recirculation (EGR) system and piston cooling jets.

Bowl-shaped combustion chambers are also used to create more turbulence within the cylinders, in conjunction with a dual injection setup, known as 'Dualjet'. Versions so equipped are also fitted with Suzuki's Engine Auto Stop-Start System (EASS).

When launched in 2015, the K10C-powered Celerio was the 'cleanest' car available in the UK for an on-the-road price of under £10,000, with a CO2 rating of 84g/km and an official combined consumption figure of 78.4mpg.

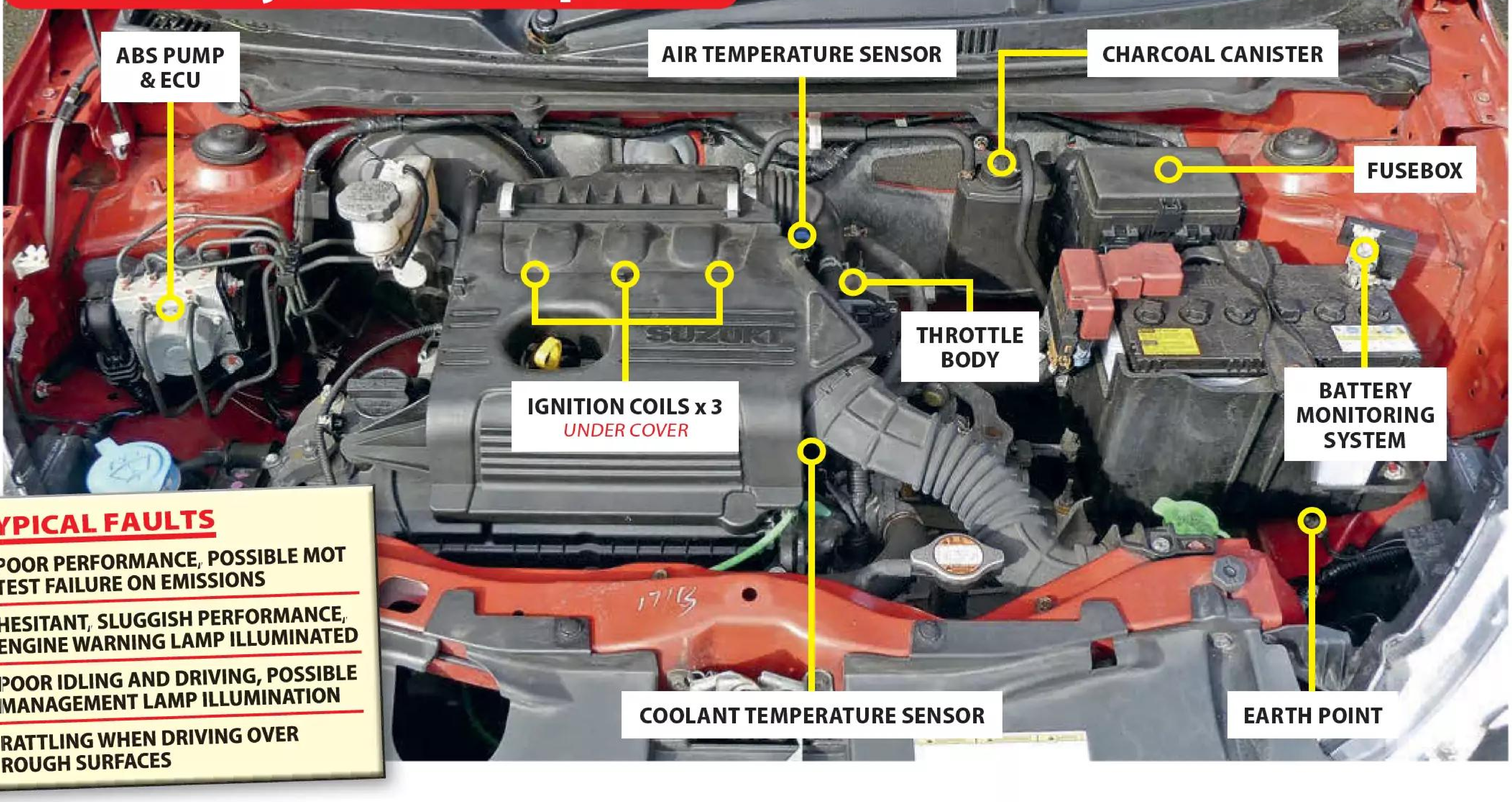
Although the Thai-built Celerio was classed as a city-car hatchback, all variants feature five doors and five seats, and incorporate greater cabin room and boot space than many rivals.

The car featured here was registered in May 2016 and is powered by Suzuki's three-cylinder 1.0-litre K10B engine.

Preparation

There's plenty of room around the engine and it's an easy unit to look after for a do-it-yourself mechanic. The engine is equipped with a timing chain rather than a belt.

998cc 3-cylinder 12v petrol



TYPICAL FAULTS

① POOR PERFORMANCE, POSSIBLE MOT TEST FAILURE ON EMISSIONS

② HESITANT, SLUGGISH PERFORMANCE, ENGINE WARNING LAMP ILLUMINATED

③ POOR IDLING AND DRIVING, POSSIBLE MANAGEMENT LAMP ILLUMINATION

④ RATTLING WHEN DRIVING OVER ROUGH SURFACES

As with Suzuki engines generally through the years, these engines have proved to be very reliable in service.

Changing the oil and filter at least as often as recommended by Suzuki is a good move to maintain reliability and to help extend engine life.

Fault 1:

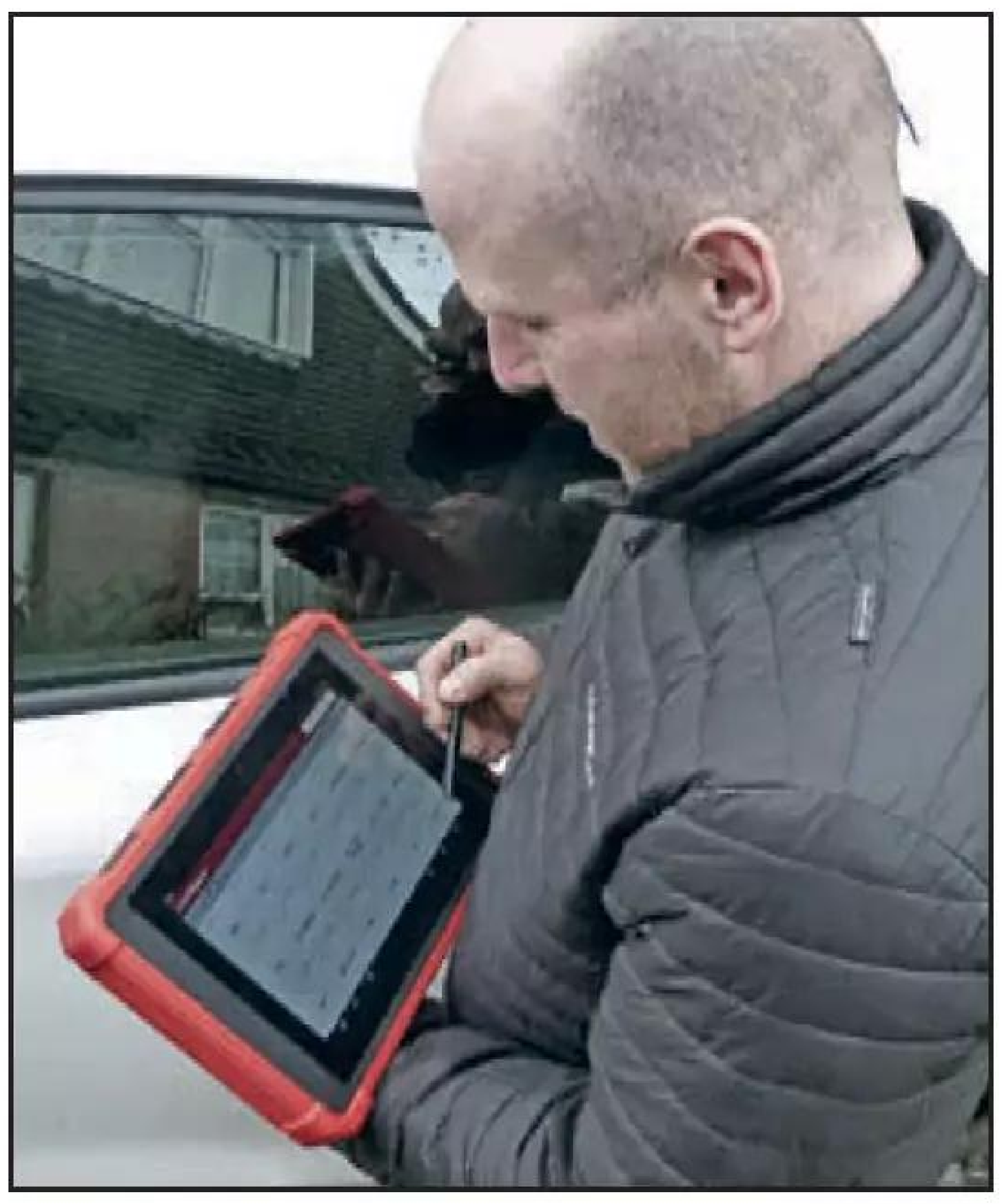
THROTTLE POSITION SENSOR TROUBLES

When this fault arises the car may feel hesitant, and sluggish when driving up hills, but may be fine at low revs. The engine management warning light will come on intermittently when the fault

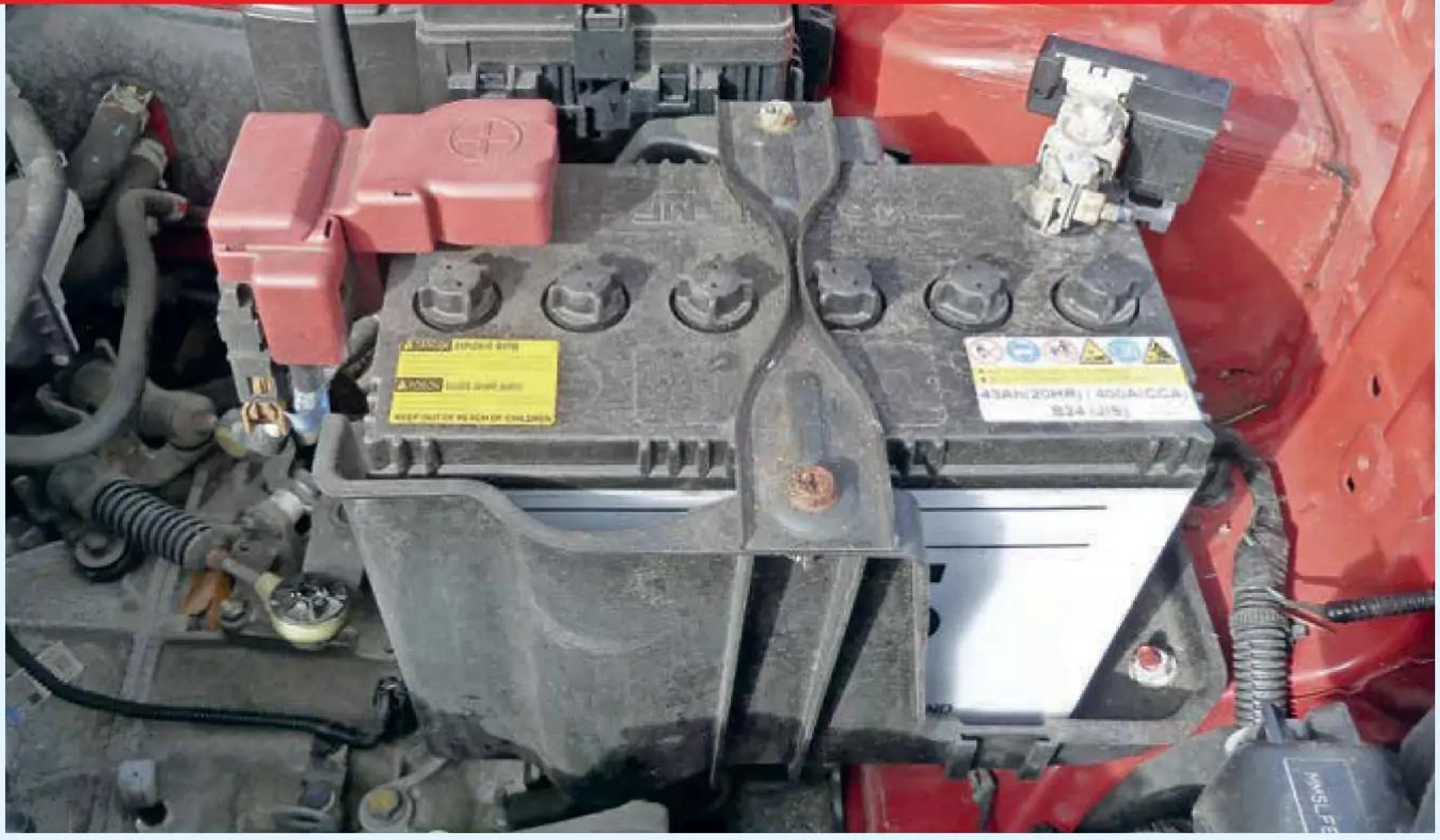
Tool of choice

▶ The Launch X431 Euro Tab II tool is perfect for in-depth assessment of this Suzuki's engine management system. The equipment enables positive identification of the actual vehicle being examined, and its main drivetrain components. The tool can also be used to show a wide variety of different useful screenshots, for example including those showing system components/computers present around the vehicle, live data and so on. The Launch equipment can easily and rapidly be set-up by the operator to control/operate individual systems and components remotely (by Bluetooth).

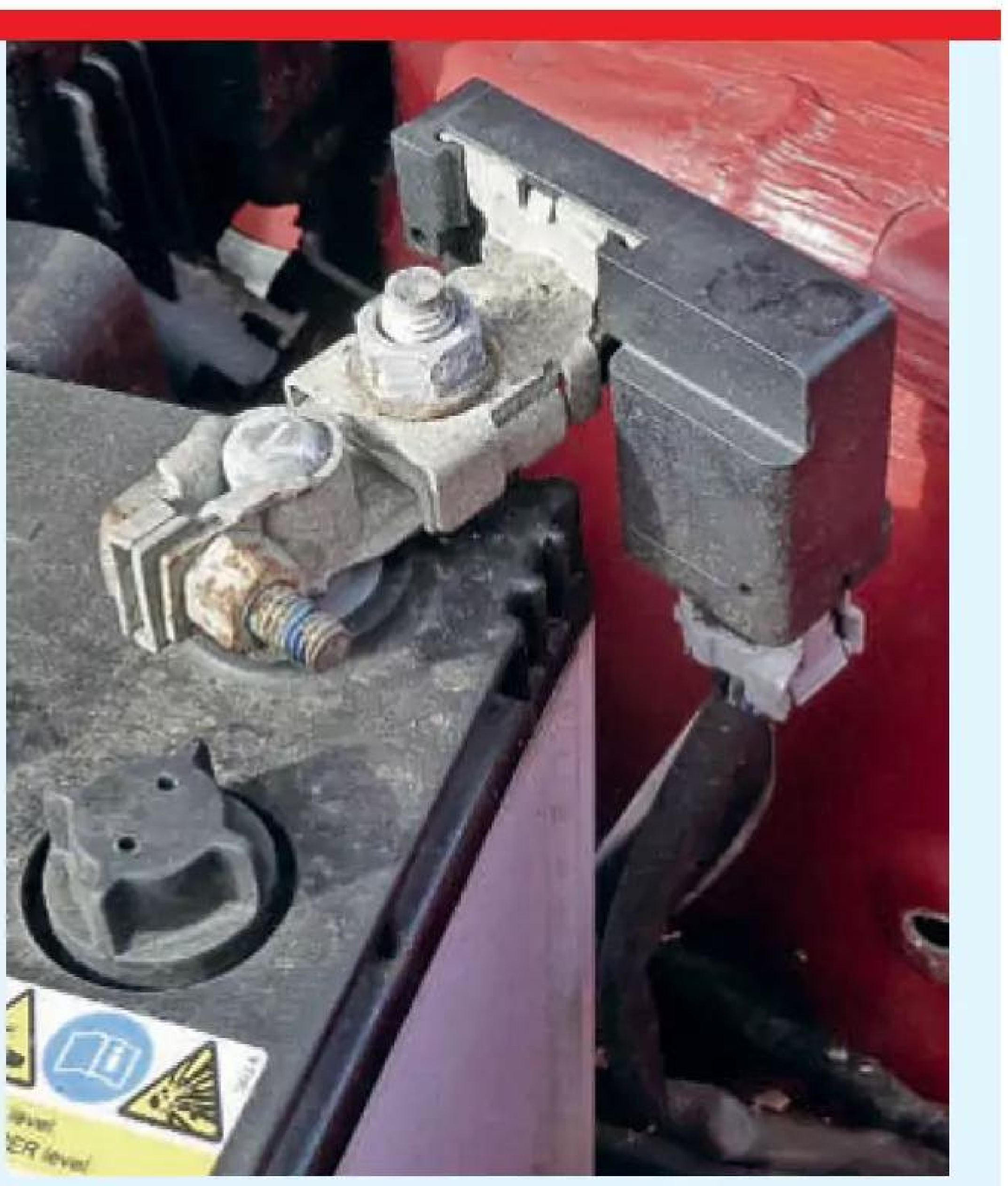
The Launch tool can also be used for a wide variety of other makes and models.



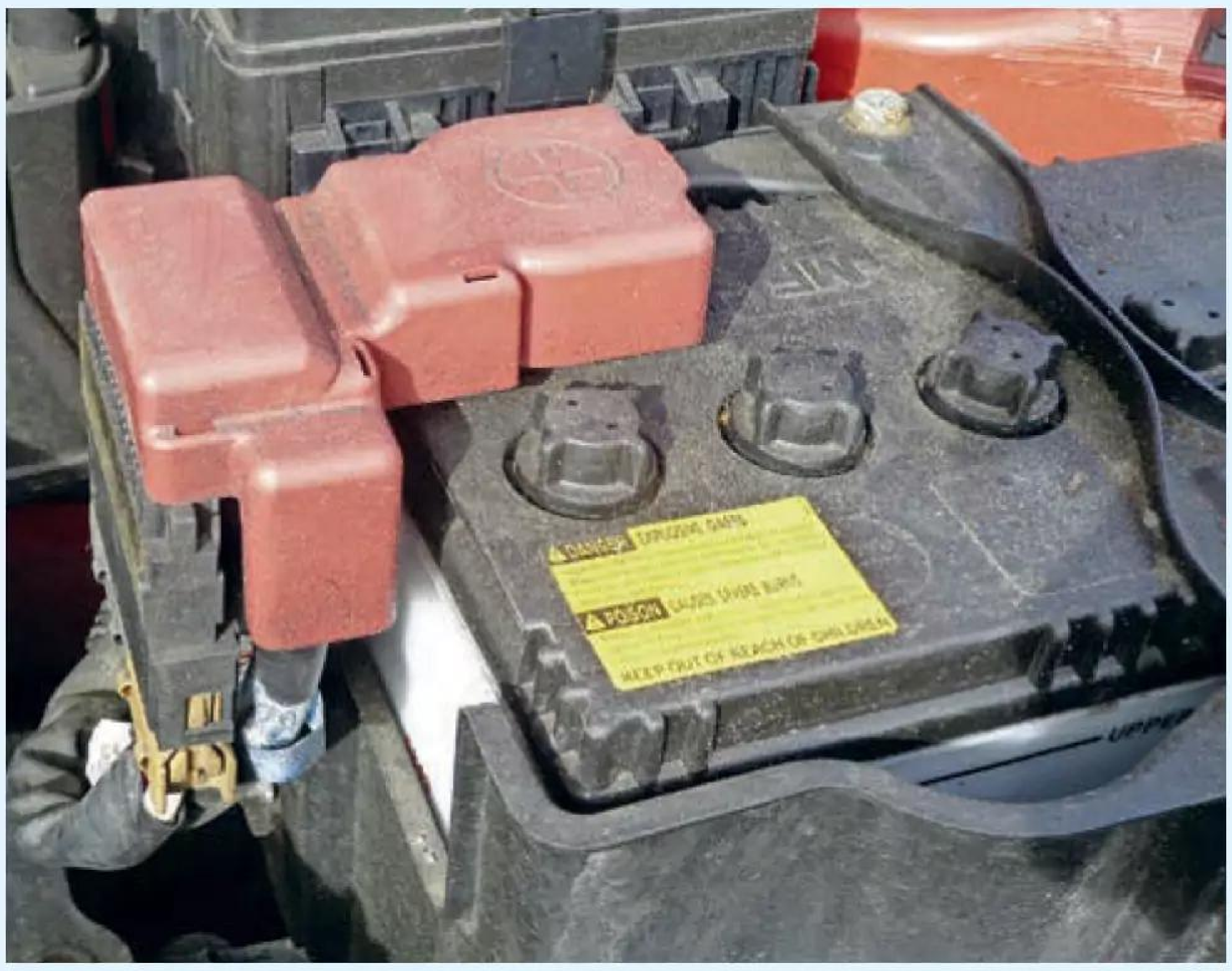
Typical Suzuki Celerio components



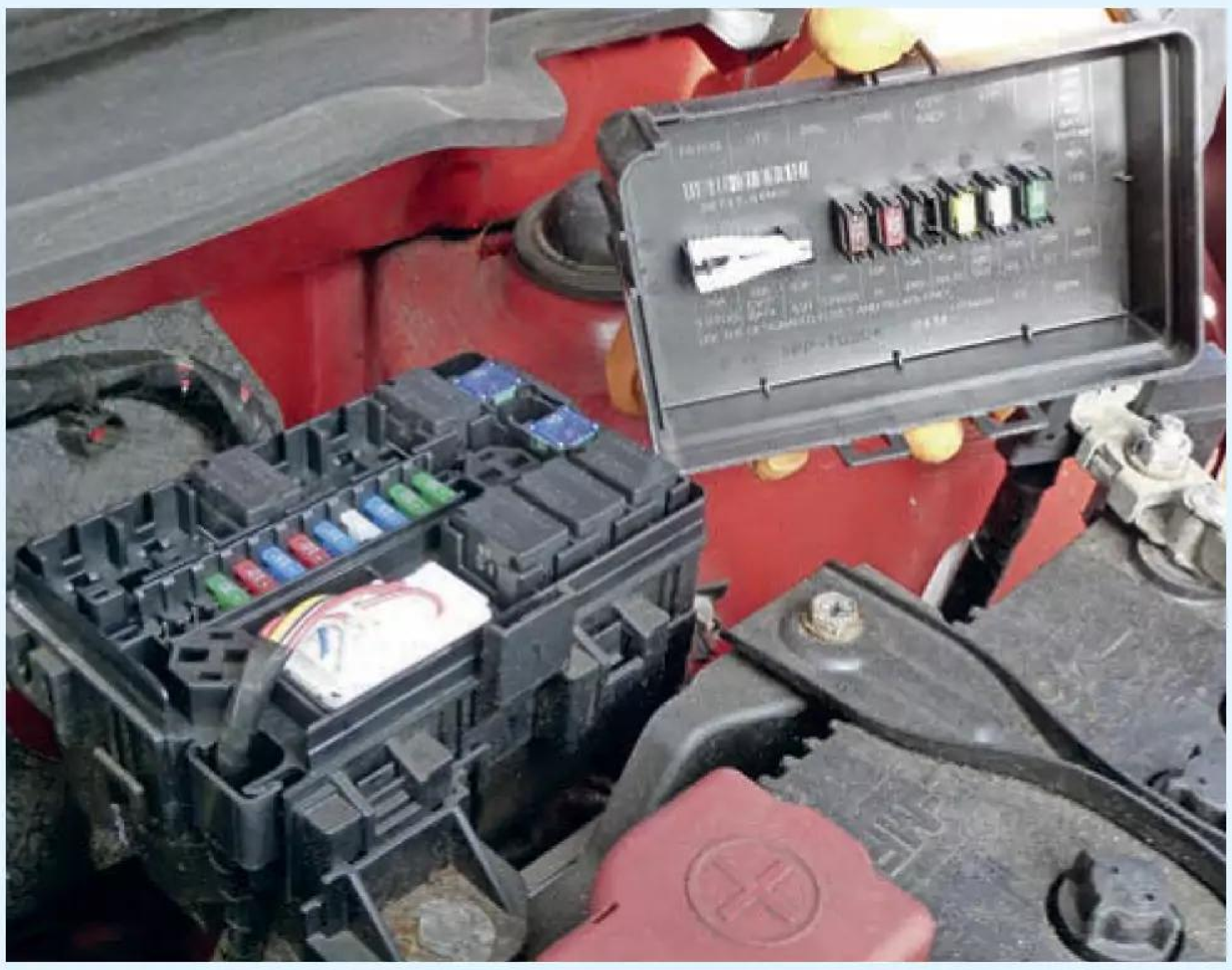
1 The battery is easily accessible on the left-side of the engine bay, just ahead of the left-hand front suspension tower. It's important that the correct type of battery is used; for this Celerio with the K10B engine, it's a traditional 12-volt type. For the K10C Dualjet cars with the EASS system, they require a special battery to Suzuki specification.



2 The negative post assembly on the 12V battery incorporates a battery monitoring system. Check the terminal and clamp assembly for signs of corrosion – also for security of the clamp. Apply silicone grease or petroleum jelly for future protection.



3 The main fuses are built into the battery's positive terminal assembly. Avoid jump-starting the vehicle (trickle-charge the battery instead) since this can cause main fuse failure. If that happens, the complete unit must be renewed – not just the fuse.



4 The underbonnet fuse and relay box is found on the left-hand side of the engine bay, towards the rear. The underside of the lid displays a handy guide regarding the various fuses and relays and their electrical ratings. Ensure that the lid is refitted correctly.

⇨

ENGINE MANAGEMENT

This Celerio incorporates these primary components:

- ▶ Solenoid type fuel injectors x 3.
- ▶ Pencil style ignition coils x 3.
- ▶ Multi-plug ECU.
- ▶ Fly-by-wire throttle body incorporating throttle position sensor.
- ▶ Coolant temperature sensor relaying engine temperature to ECU.
- ▶ Analogue crankshaft sensor.
- ▶ Engine breather incorporated in the cam cover.
- ▶ Fuel pump in-tank.
- ▶ Pre- and post-catalyst oxygen/O2/Lambda sensors.
- ▶ Brake pedal position sensor fitted to pedal.
- ▶ Throttle position sensor attached to throttle pedal.
- ▶ EGR valve.
- ▶ EVAP canister in engine bay.

occurs, but turning the ignition off and on again will clear the dash warning light.

Carrying out a diagnostic fault check will show 'P0120 throttle position' or similar. Now via 'actual values' look at the throttle position screenshot showing a graph (remember, you're looking at throttle body position *not* throttle pedal), and you need to be seeing a gradual incline with no peaks or drops. Note that a failed TPS will show up in the form of drop-outs at higher revs… Remember that the ECU needs this information to set the required fuel/air mixture.

Edward adds that in terms of replacement sensors he has found that buying secondhand is the best way to go for these units, because when new they are very expensive.

Fault 2:

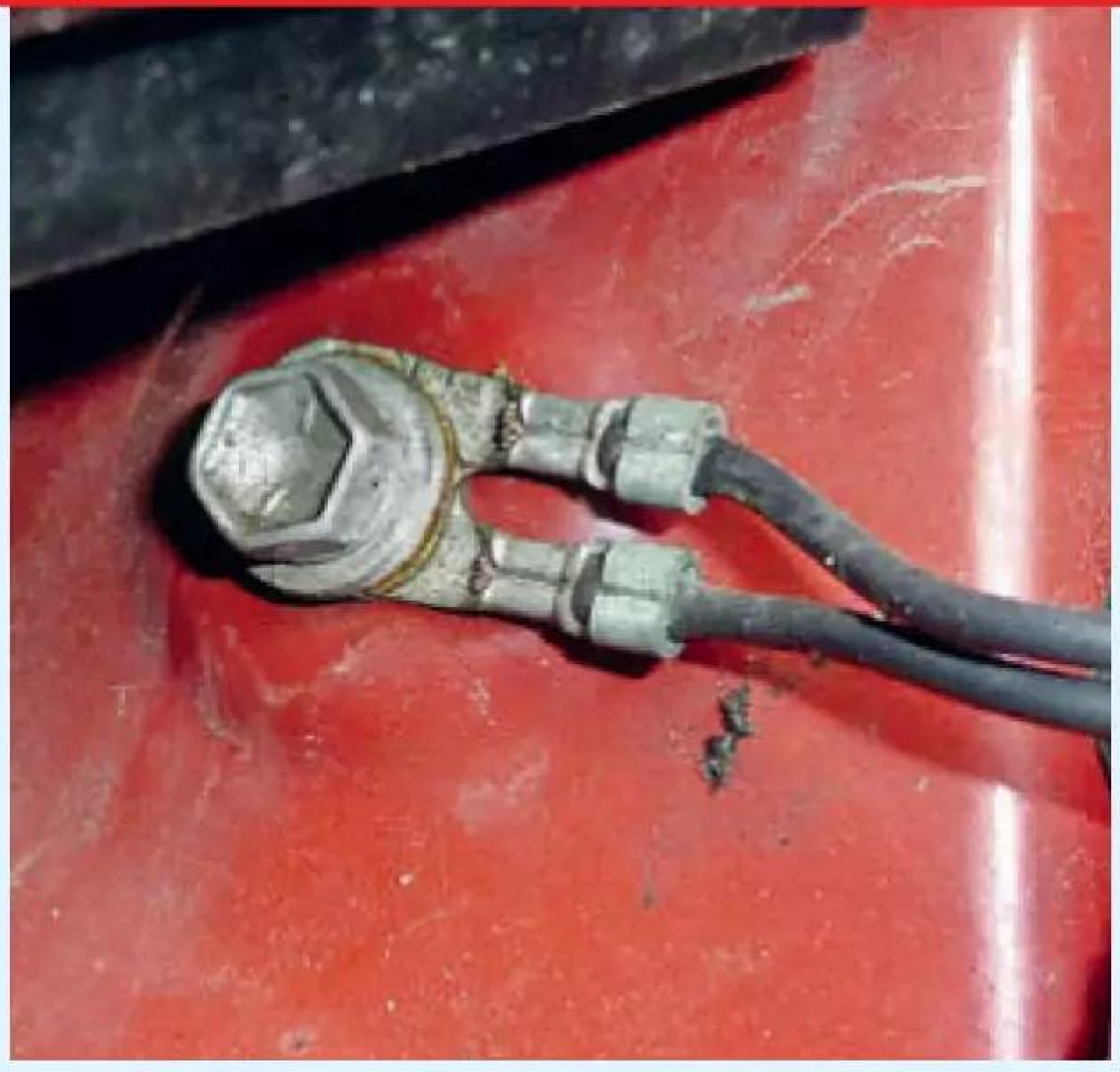
IGNITION COIL FAILURE

A poor idling quality and below-par performance when driving will be evident when this fault is present. In the early stages the engine management warning light may not be illuminated – but if the trouble is not fixed and left to its own devices, almost certainly the light will be on, and the system will register a code relating to 'cylinder misfire'.

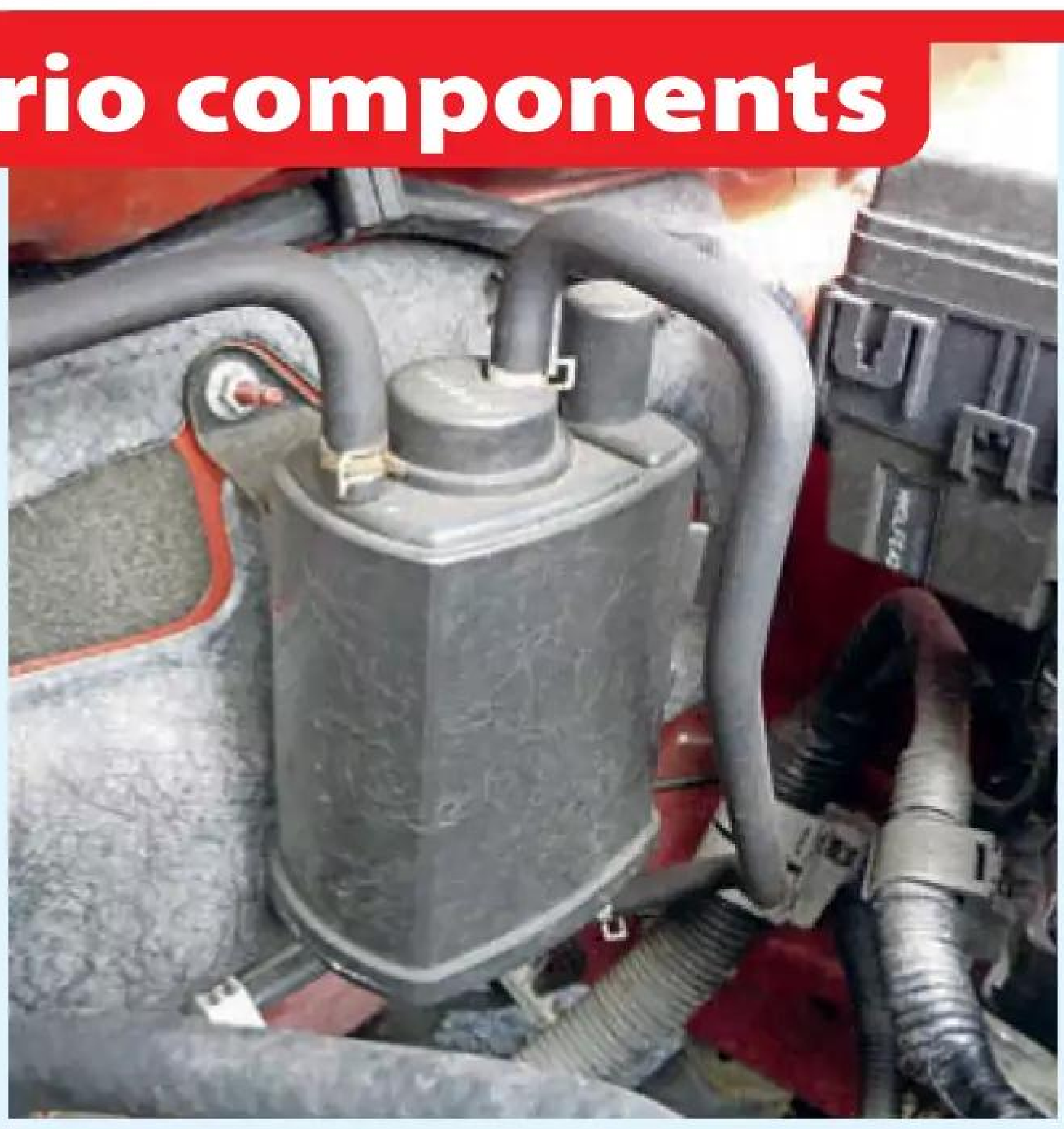
Usually it won't be necessary to use a diagnostic tool to find the fault… Remove the ignition coils individually and check for signs of arcing – you will see where the spark has been escaping and not finding its way to the cylinder concerned.

Edward says that it's worth noting that

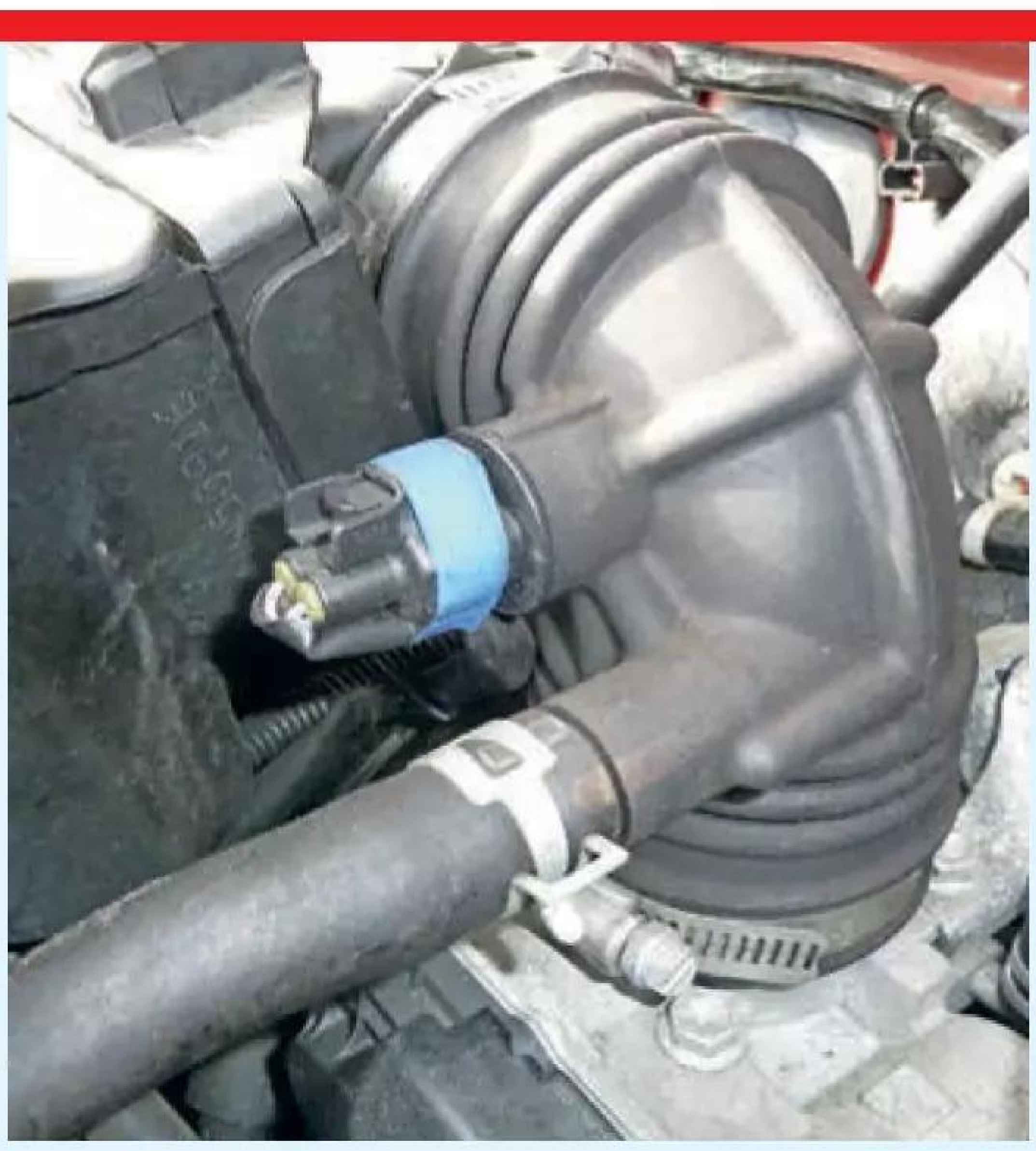
Typical Suzuki Celerio components



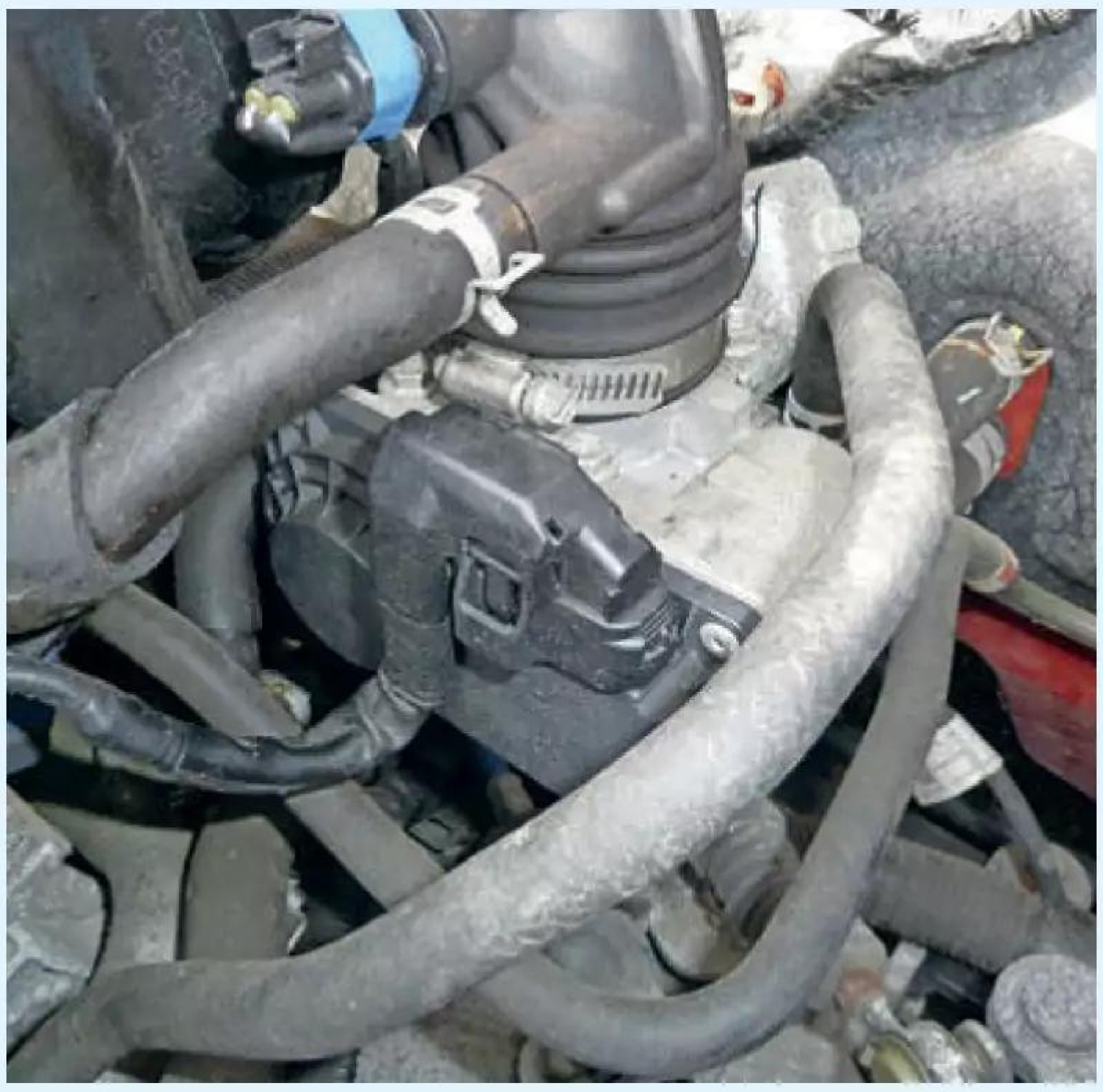
5 **There's an important earth point located on the left-hand front suspension tower. Ensure that the connection here is clean, sound and secure. If necessary, separate the connection, clean and apply silicone grease or petroleum jelly.**



6 **Mounted towards the left-hand side on the rear bulkhead within the engine compartment is the charcoal canister assembly forming part of the emissions control system. Check for cleanliness, also for signs of damage and splits in the hoses.**

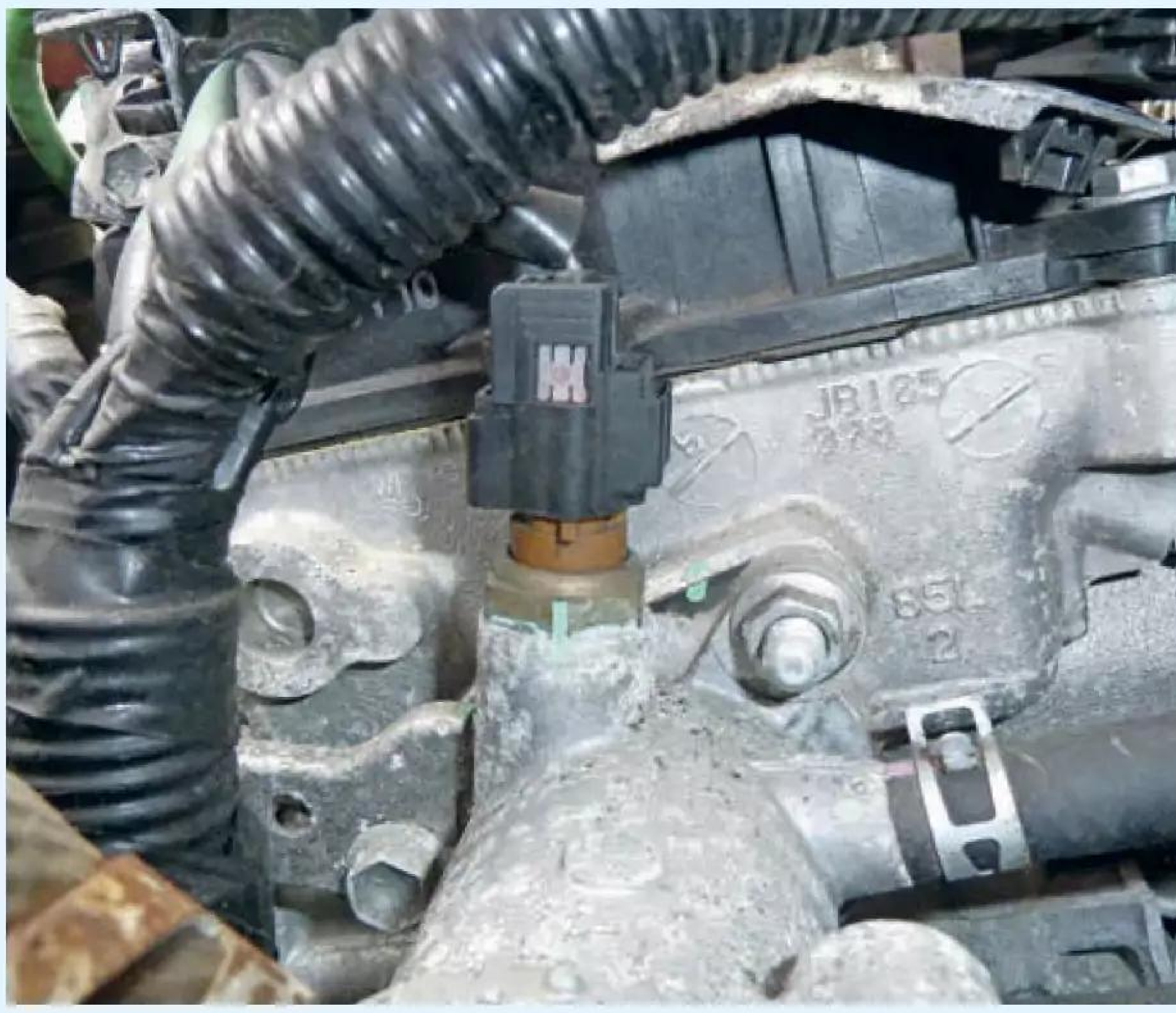


7 **The air temperature sensor, positioned within the intake trunking, is crucially important in helping the ECU determine correct fuelling levels. Inspect the wiring and the security of the sensor.**



8 **◀ The throttle body assembly is easy to reach and to deal with in terms of detachment and internal cleaning, which can be carried out very carefully using proprietary purpose-developed cleaning fluid/aerosol spray, gently applied.**

9 **▶ Check the coolant temperature sensor (CTS) for coolant leakage. Assess the cleanliness/security of the cable connections and ensure that the sensor is secure. The CTS is essential for providing the ECU with engine temperature information.**



many times when he has seen this fault the vehicles concerned were poorly serviced and the spark plugs were well overdue for replacement. Worn-out spark plugs place additional strain on the coils – although he adds that he can't say 100% that failure is always due to a lack-of-maintenance issue.

He advises using quality components when replacing the coils, and ideally fitting new units. Again, though, installing good-condition secondhand coils can be a cost-effective option.

Fault 3:

INCORRECTLY SET VALVE CLEARANCES

This fault is avoidable but for many people can be difficult to diagnose. Symptoms can vary, but may include the car not driving as it should, and/or MOT test failure on emissions. However, the engine may sound fine when running at idle.

The cause may be incorrect valve clearances; checking/resetting these (they're manually adjustable) is part of the service schedule and they need to be checked because the gaps can change over time. Even the tiniest change (slightly loose or tight gaps) can cause the engine management system to compensate, ie delivering more or less fuel according to how the ECU reads the situation from the info it's receiving.

Running with the correct clearances will make a noticeable difference in terms of performance and fuel consumption.

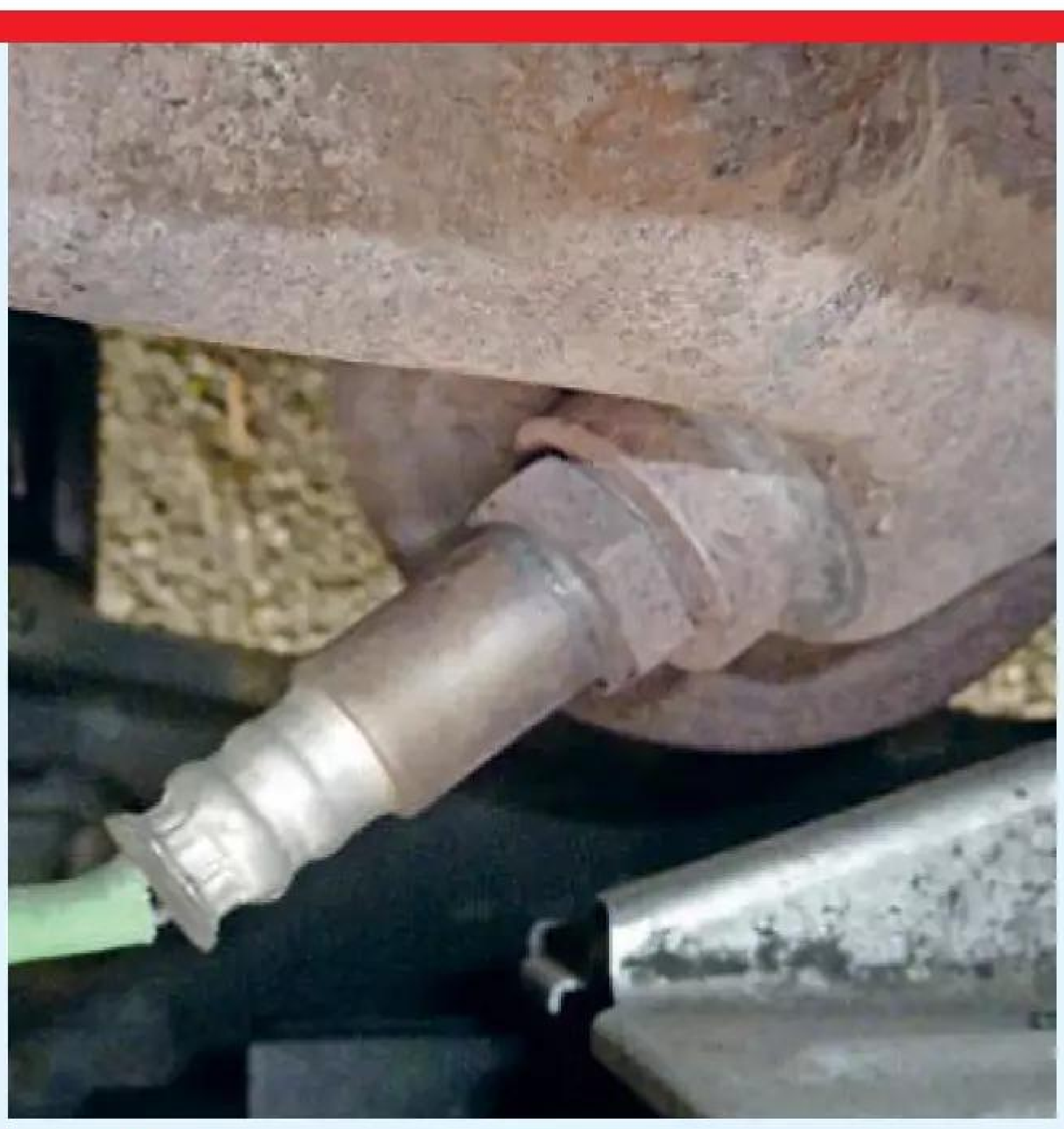
From a diagnostic point of view the operator can check fuel trims and actual values or read back pressure, but in any case if there is any doubt at all about the correctness of the settings, it is a very good idea to check and, if necessary, reset the clearances.

While the valve cover is removed, inspect the sealing gasket and ensure that it is in perfect condition (or renew regardless). A quick condition check is to place the valve cover, with gasket still attached to it, on to a flat surface and see if there are any gaps between the gasket and this surface, indicating a worn gasket.

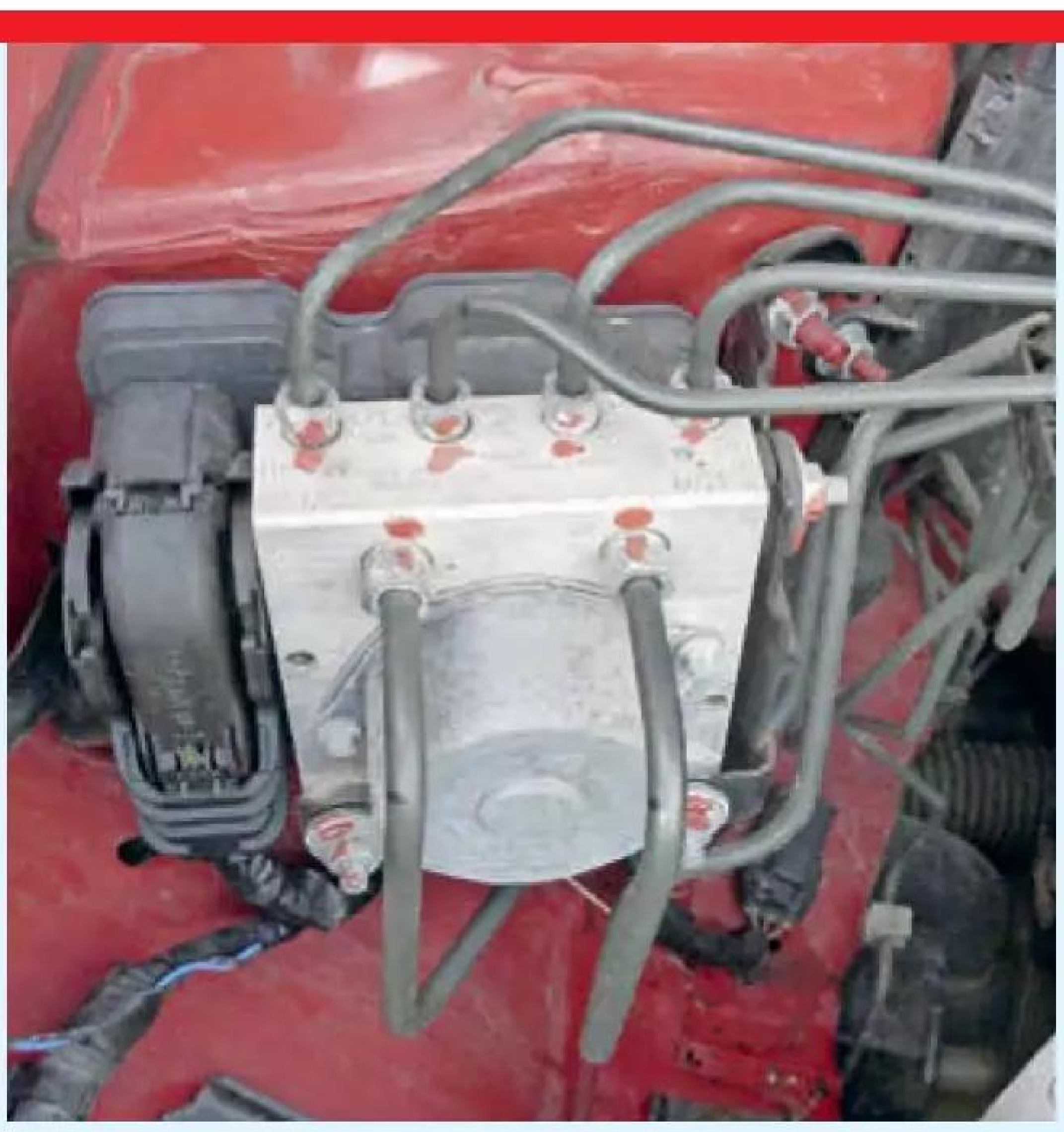
Technical Specs

Actual values

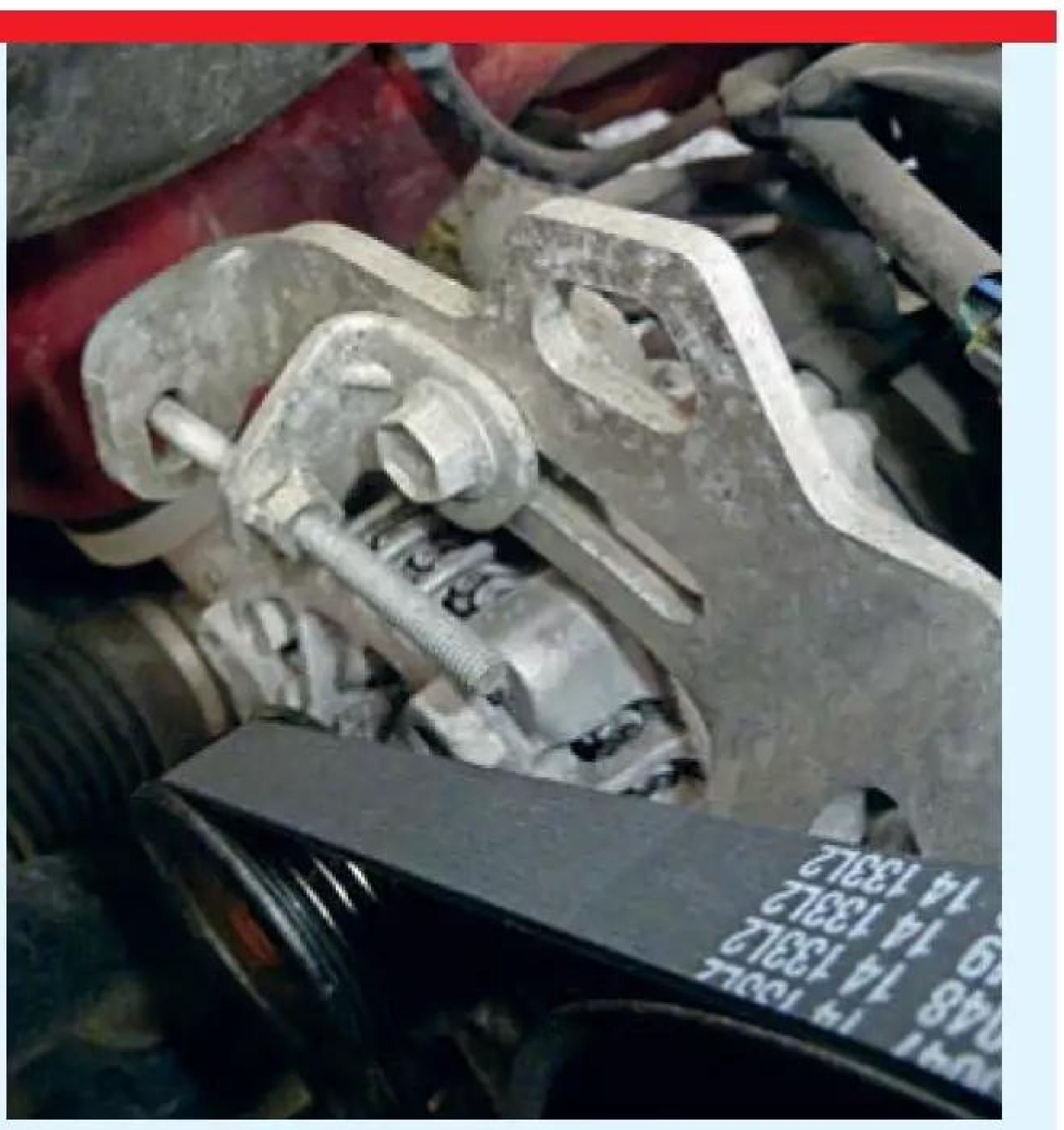
Component	Value
Valve clearances (cold)	Inlet 0.14-0.23mm Exhaust 0.30-0.40mm
Oxygen sensor heater circuit	5.0-6.4 ohms
Crankshaft sensor	220 ohms
Fuel pressure	3.8 bar
Engine coolant temperature sensor	310-330 ohms at 80°C
Fuel injector	16 ohms
Firing order	1-3-2



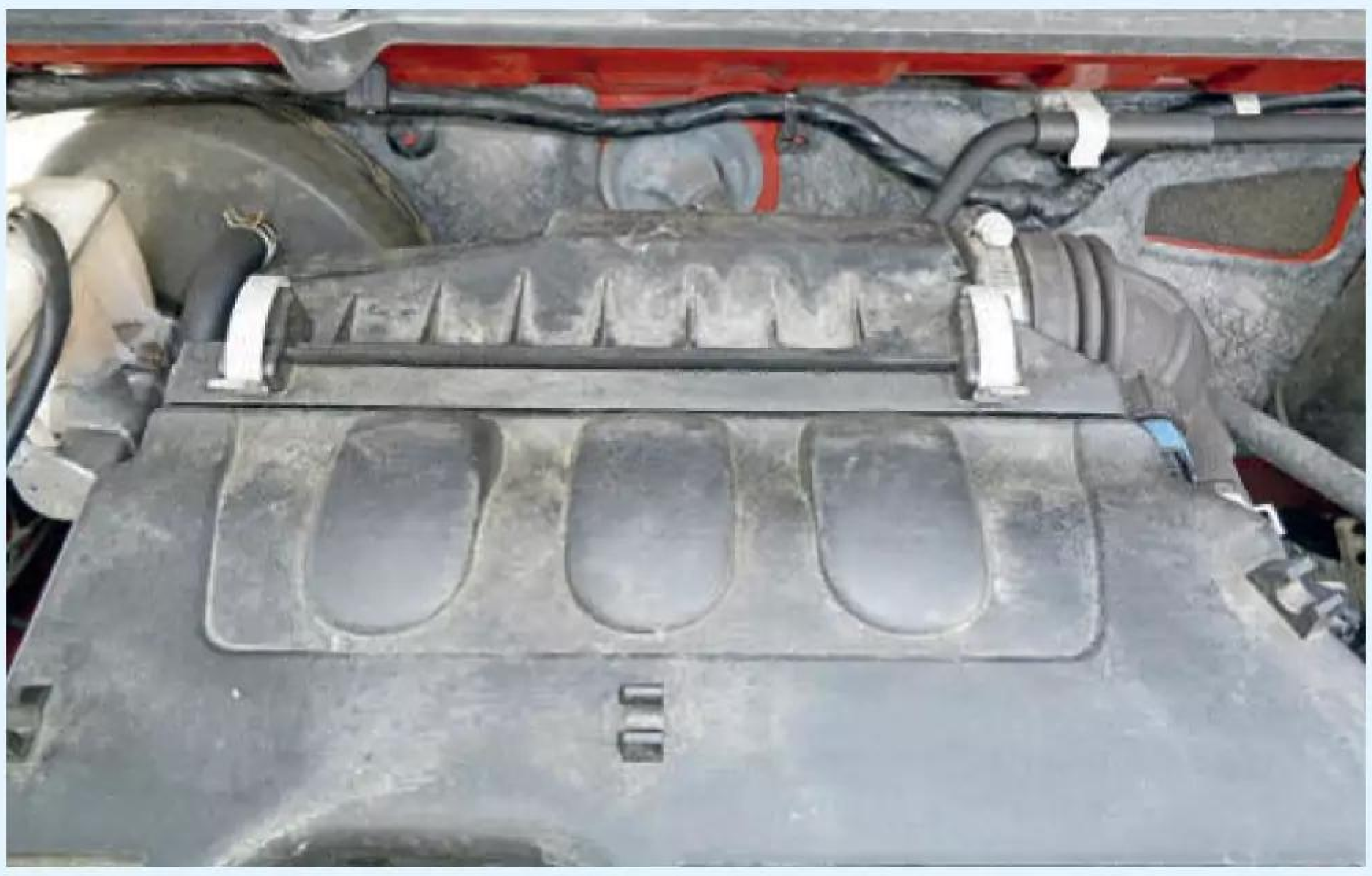
10 **The oxygen/O2/Lambda sensor is easy to reach at the front of the engine, and is located in such a position within the exhaust system so that it can quickly warm up to normal operating temperature, once the engine is running.**



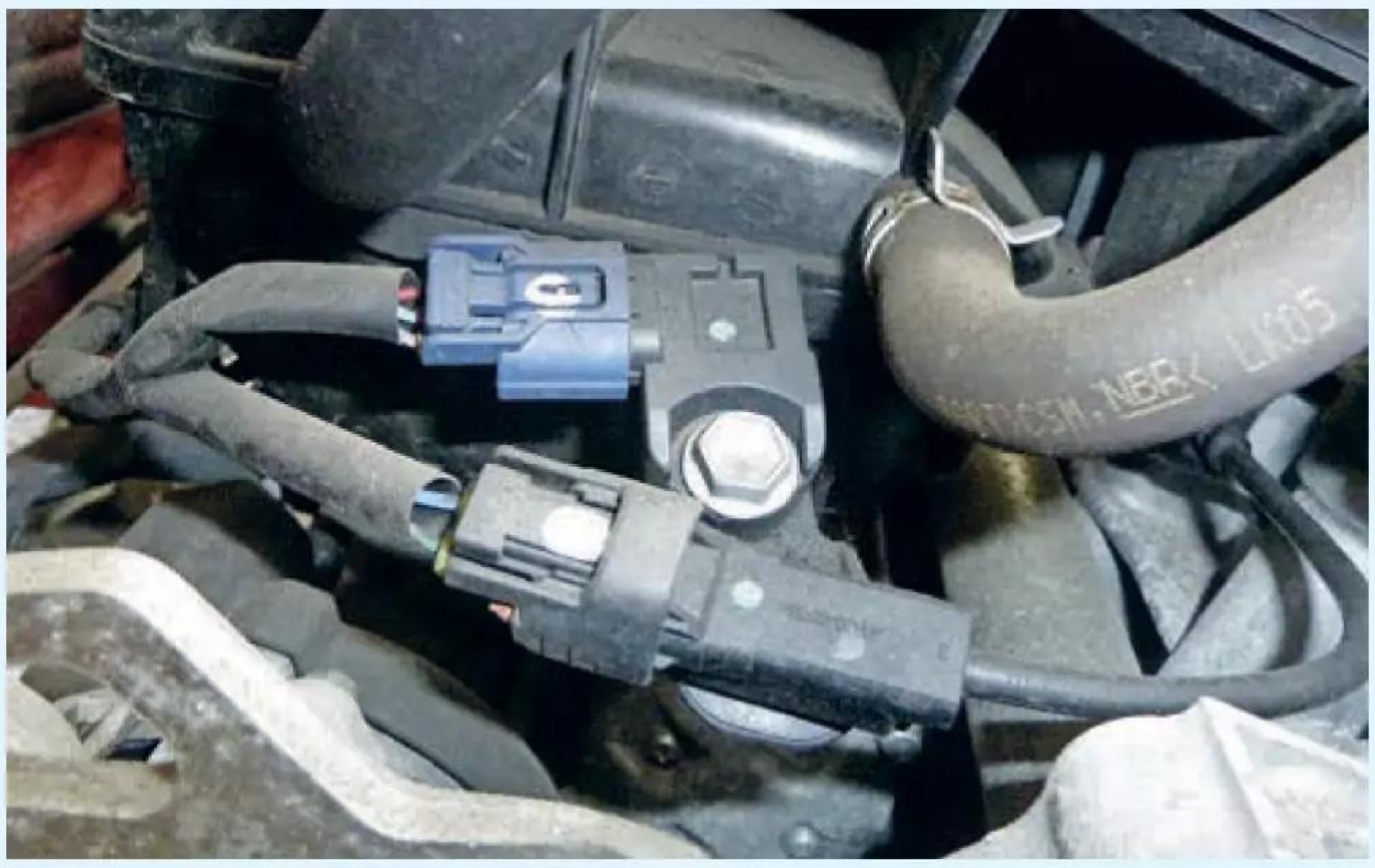
11 **The anti-lock brake system (ABS) pump and ECU are incorporated into this assembly mounted on the rear bulkhead within the engine bay. Ensure that all the pipework, cables and electrical connections are clean and sound.**



12 **This shows the clever adjuster mechanism for setting the tension in the alternator/auxiliary drive belt. To help maintain battery power at optimum levels, ensure that the belt condition and tension is checked frequently.**



13 **The air filter housing lid is secured by two 'over centre' type clips – easily released in order to gain access to the filter element; wipe clean the inside of the housing when the element is renewed. Not visible is the MAP sensor, low down on the intake manifold.**



14 **The three fuel injectors are reached once the cover panel has been removed; this requires the removal of two bolts (10mm spanner size) and releasing the securing clips. Check for signs of deterioration in the vicinity of the injectors.**

Fault 4:

DRY PINS ON BRAKE CALIPERS

This may sound like a strange problem, but you may hear a rattle from the front of the car when driving over bumpy surfaces. It's a difficult fault to diagnose if you've not come across it before.

The fault is dry pivot pins on the brake calipers – rectification is simply a case of stripping down the front calipers, removing the pins, cleaning them up and applying a light coating either of brake grease or copper grease, then re-assembling. Hey presto, the rattling should have disappeared.

USEFUL PREPARATION DATA

Below are shown the official recommended change intervals for the various components. However, Edward advises that these service/change intervals are at least halved.

Service intervals Officially every 12,500 miles or 12 months, whichever comes first.

Spark plugs Officially renew every 62,500 miles or 60 months, whichever comes first.

Spark plug type NGK KR6A-10, Denso ZXU20PR11 or equivalent.

Air filter Officially renew every 37,500 miles or 12 months, whichever comes first.

Engine oil Every 12,500 miles or 12 months, whichever comes first.

Oil Type SAE 0W-20 fully-synthetic. Use Suzuki recommended specification oil.

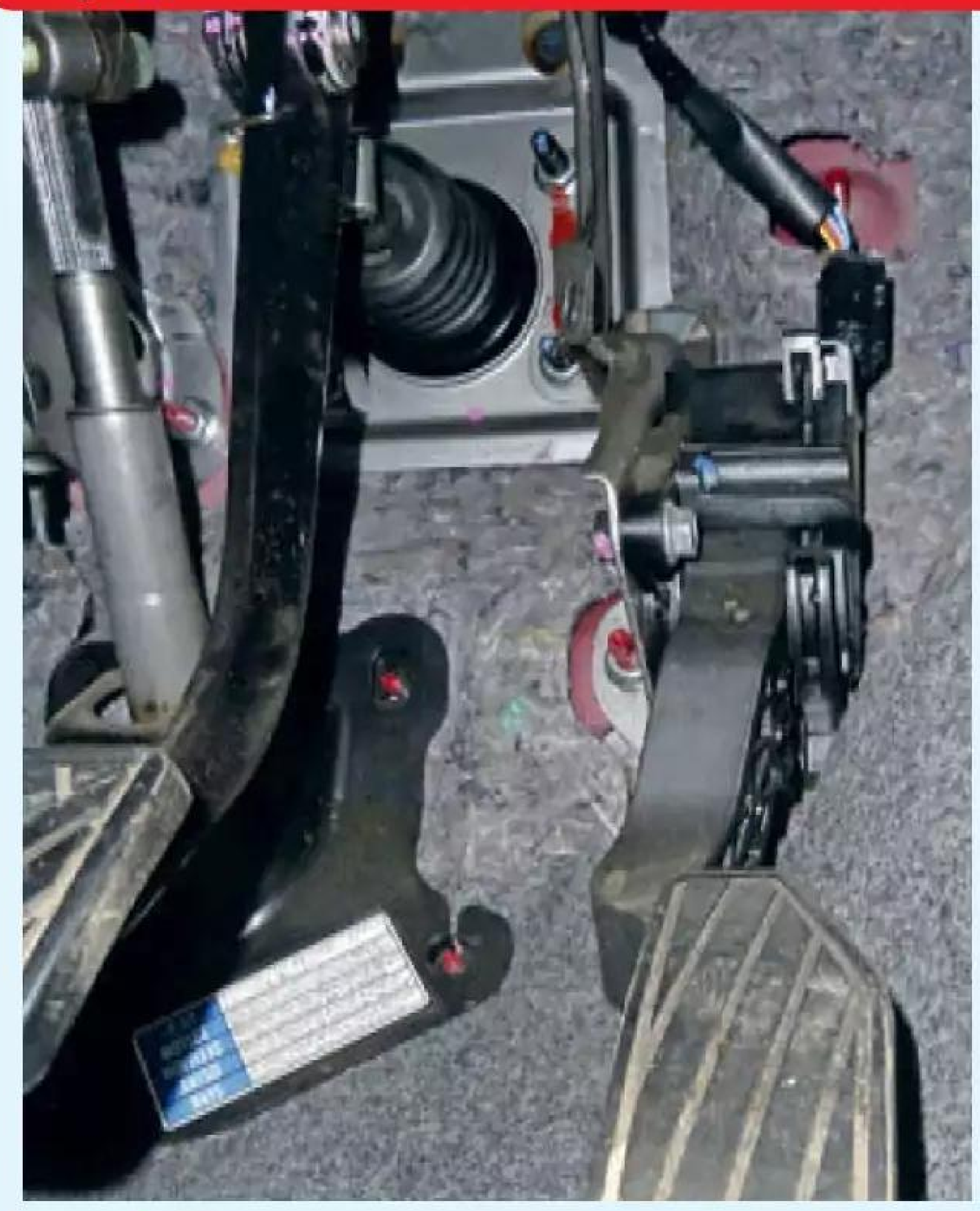
Capacity ('service' fill) 3.1 litres.

Oil filter torque setting 14Nm.

Sump plug torque setting 35Nm.

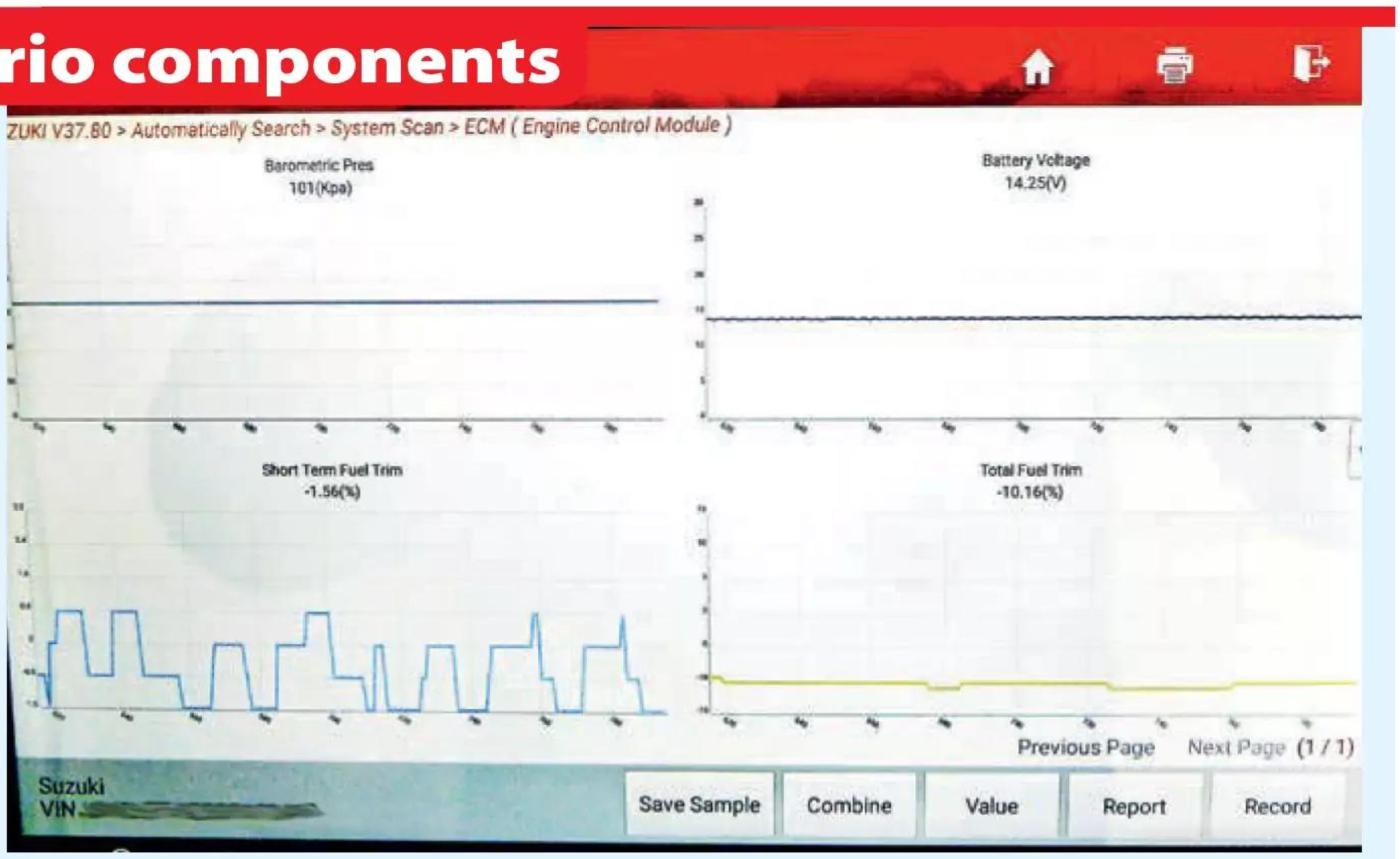
Brake fluid Every 24 months.

Typical Suzuki Celerio components



15 **The upper end of the accelerator pedal assembly incorporates the throttle position sensor unit. Make sure that all the cables and connections are clean and secure. It may sound obvious but ensure that any floor mats don't slide forward and restrict throttle pedal movement – this often happens!**

17 **Here's the Launch diagnostic tool's 'Smart Box' cable assembly plugged into the diagnostic socket, ready to transmit data to the tool's screen. Edward says the Launch tool is quick to connect and finding this Suzuki model within the tool's set-up phase is 'super easy' too.**



ZUKI V37.80 > Automatically Search > System Scan > ECM (Engine Control Module)

Barometric Pres 101(Kpa)

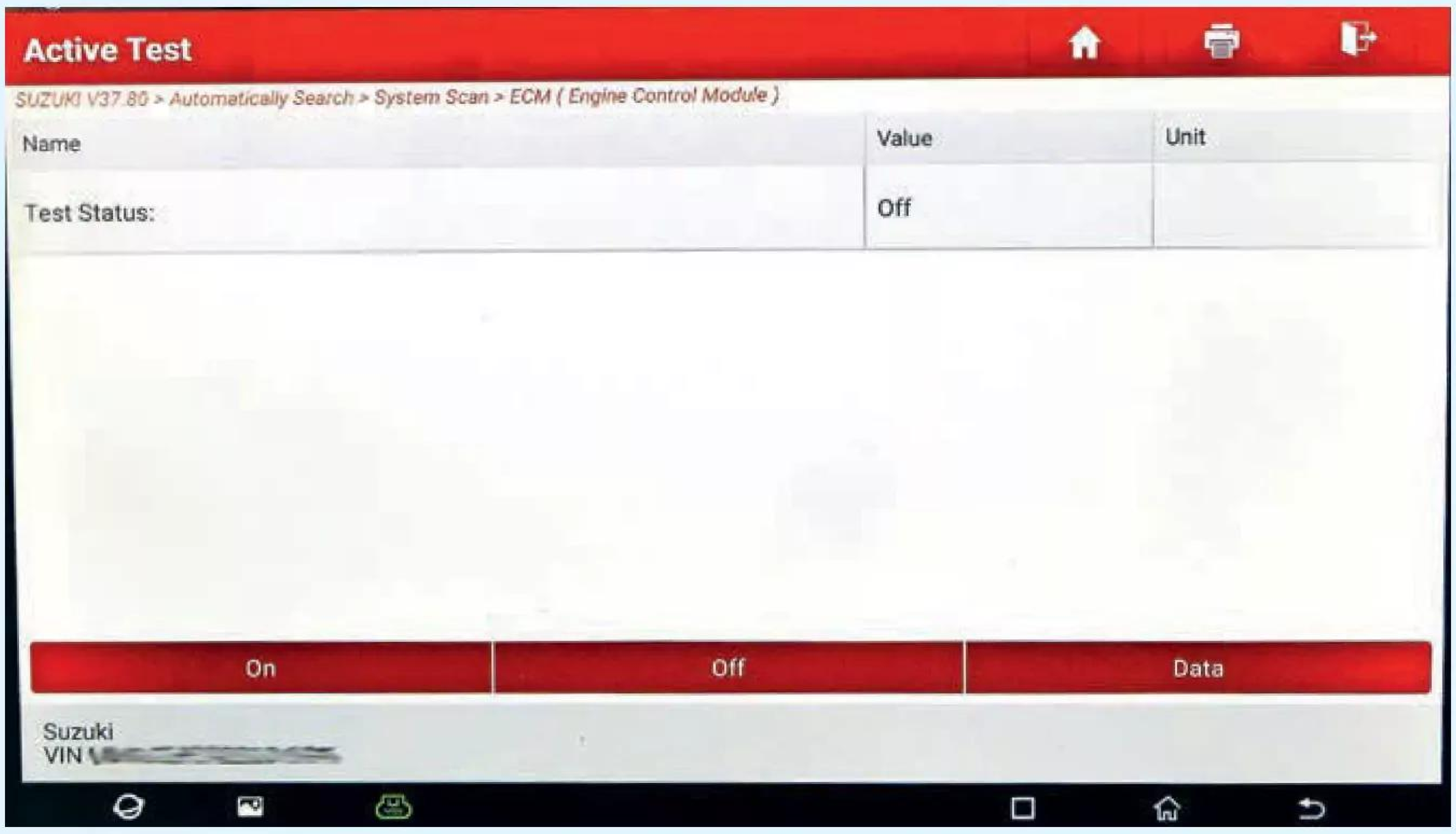
Battery Voltage 14.25(V)

Short Term Fuel Trim -1.56(%)

Total Fuel Trim -10.16(%)

Suzuki
VIN [redacted]

16 **This screenshot on the Launch X431 Euro Tab II tool indicates actual values according to what the vehicle's selected ECU is seeing/recording. In this particular case, Edward has selected MAP sensor, battery voltage and fuel trim adaptions. The operator can see – by means of figure changes in the graphs – any signal communication faults.**



Active Test

SUZUKI V37.80 > Automatically Search > System Scan > ECM (Engine Control Module)

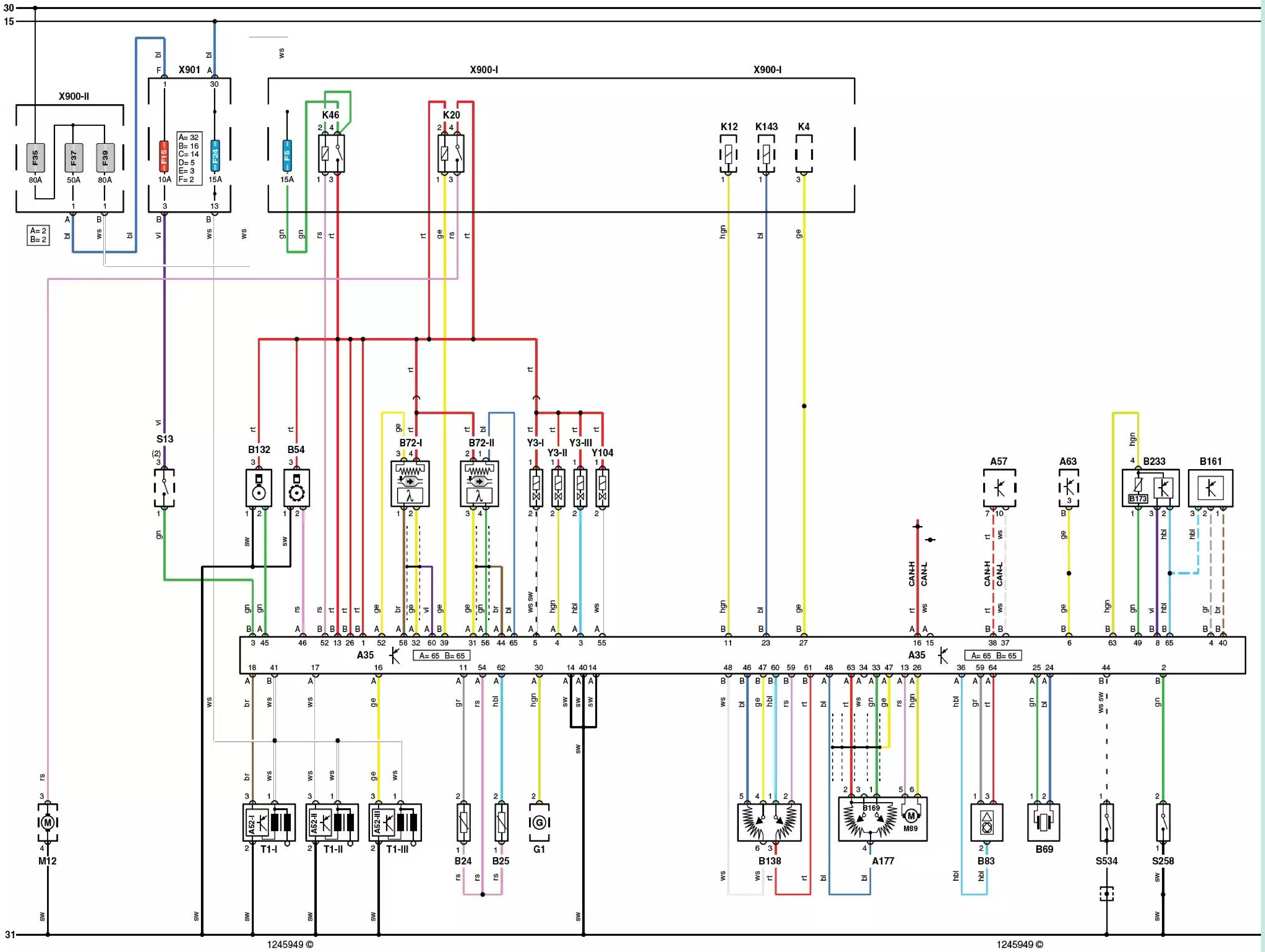
Name	Value	Unit
Test Status:	Off	

Suzuki
VIN [redacted]

18 **This screenshot relates to testing the engine cooling fan, with Edward commanding the tool to operate the fan (and bypassing the usual switch on the vehicle itself). This facility – to operate the various systems on the car using the Launch diagnostic equipment – is especially useful becauses it enables the operator to quickly check/confirm the operational status of, and faults within, the relevant wiring, electric motor, etc.**

SUZUKI CELERIO CIRCUIT DIAGRAM

www.autodata-group.com


30
15
31
X900-II
X901
X900-I
F35 80A
F37 50A
F39 80A
F15 10A
F24 15A
F5 15A
A= 32 B= 16 C= 14 D= 5 E= 3 F= 2
A= 2 B= 2
K46
K20
K12
K143
K4
S13
B132
B54
B72-I
B72-II
Y3-I
Y3-II
Y3-III
Y104
A57
A63
B233
B173
B161
CAN-H
CAN-L
A35
A= 65 B= 65
M12
T1-I
T1-II
T1-III
A52-I
A52-II
A52-III
B24
B25
G1
B138
B169
M89
A177
B83
B69
S534
S258
1245949 ©

CODE	COMPONENT DESCRIPTION
A35	ENGINE CONTROL MODULE (ECM)
A52-I	IGNITION AMPLIFIER | **1**
A52-II	IGNITION AMPLIFIER | **2**
A52-III	IGNITION AMPLIFIER | **3**
A57	TRANSMISSION CONTROL MODULE (TCM)
A63	AC CONTROL MODULE
A177	THROTTLE CONTROL UNIT
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B25	INTAKE AIR TEMPERATURE (IAT) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B69	KNOCK SENSOR (KS)
B72-I	HEATED OXYGEN SENSOR (HO2S) | **1**
B72-II	HEATED OXYGEN SENSOR (HO2S) | **2**
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B132	CAMSHAFT POSITION (CMP) SENSOR
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
B173	BATTERY TEMPERATURE SENSOR
B233	BATTERY CONDITION SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
F	FUSE
G1	ALTERNATOR
K4	STARTER MOTOR RELAY
K12	ENGINE COOLANT BLOWER MOTOR RELAY
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
M12	FUEL PUMP (FP)
M89	THROTTLE MOTOR
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S258	CLUTCH PEDAL POSITION (CPP) SWITCH
S534	BRAKE SERVO PRESSURE SWITCH
T1-I	IGNITION COIL | **1**
T1-II	IGNITION COIL | **2**
T1-III	IGNITION COIL | **3**
X900-I	FUSEBOX/RELAY PLATE, ENGINE BAY | **1**
X900-II	FUSEBOX/RELAY PLATE, ENGINE BAY | **2**
X901	FUSEBOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | **1**
Y3-II	INJECTOR | **2**
Y3-III	INJECTOR | **3**
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

DACIA DUSTER 1.2 PETROL

Tracing and fixing faults in electronic engine management systems

The Dacia Duster has proved to be popular with British buyers... but how does the compact SUV fare in diagnostic terms? **Kim Henson** and **Edward Haggar** investigate its prospects.

NOTE:
All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

The Renault-derived Dacia Duster five-door compact SUV was introduced at the 2010 Geneva Motor Show, and made its UK debut in 2012. The model, produced in conjunction with Renault's Romanian subsidiary firm of Dacia, was hailed as a competent vehicle that offered high levels of practicality coupled with excellent value for money.

A facelift/minor restyle was applied in 2013 and second-generation Dusters were introduced in the autumn of 2017.

The example featured in our photographs is a first-generation Duster and was registered in September 2017. It is powered by a twin-overhead camshaft four-cylinder 1198cc petrol turbo engine. Our diagnostic guide to this Dacia is Edward Haggar.

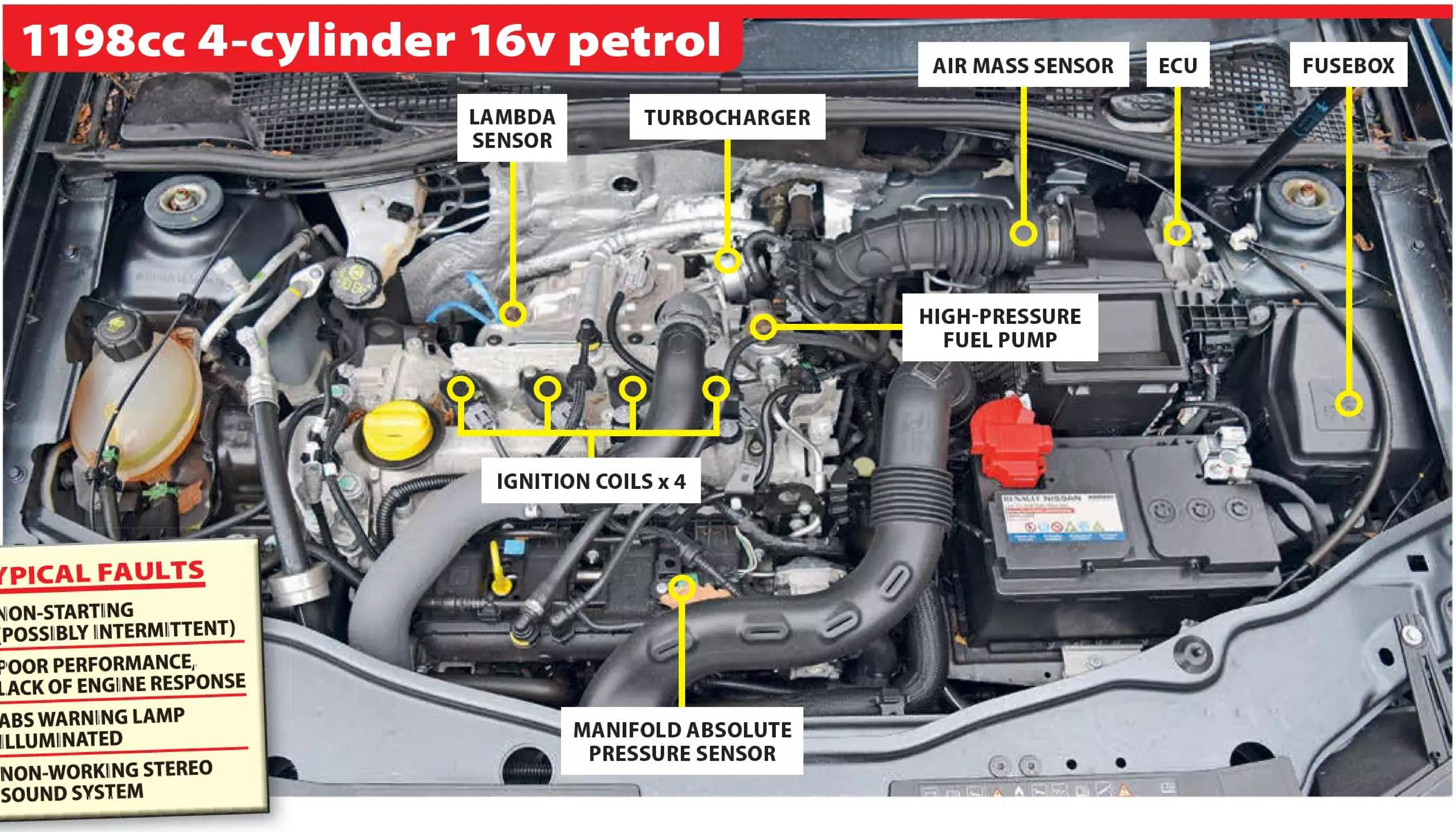
Edward is pretty impressed with the Dacia range of models, in terms of supreme ease of servicing and the fact that buyers can opt for a basic car that (for example) even lacks electrically operated windows.

Underbonnet space is reasonably generous around the power unit and its ancillaries, aiding routine servicing operations. Note that, unusually these days, the engine incorporates adjustable valve clearances, so these need to be correct for optimum driveability, fuel consumption and emissions performance. There is no cambelt to worry about because this engine has a timing chain instead of a belt.

Edward adds that it is worth noting that from a diagnostic point of view, if your chosen scanner code reader doesn't have a 'Dacia' option, you can try interrogating the Duster's systems by selecting/going in via 'Renault'.

By contrast with many earlier Renaults, the Dacias (including the Duster) have so far proved to be much more reliable, which is encouraging news for owners or potential buyers.

1198cc 4-cylinder 16v petrol



TYPICAL FAULTS

1. NON-STARTING (POSSIBLY INTERMITTENT)
2. POOR PERFORMANCE, LACK OF ENGINE RESPONSE
3. ABS WARNING LAMP ILLUMINATED
4. NON-WORKING STEREO SOUND SYSTEM

Edward says that the only negative in this respect is that because these vehicles are built to a budget, the interior switches (etc) may not last as long as expected. The stereo system can also play up; see *Fault 4*.

Fault 1:

FAILING BATTERY

When this problem occurs, the driver may find the Duster difficult or impossible to start. The root cause is a failing battery, which seems to be a commonly encountered phenomenon with Dacias and Renaults of this era.

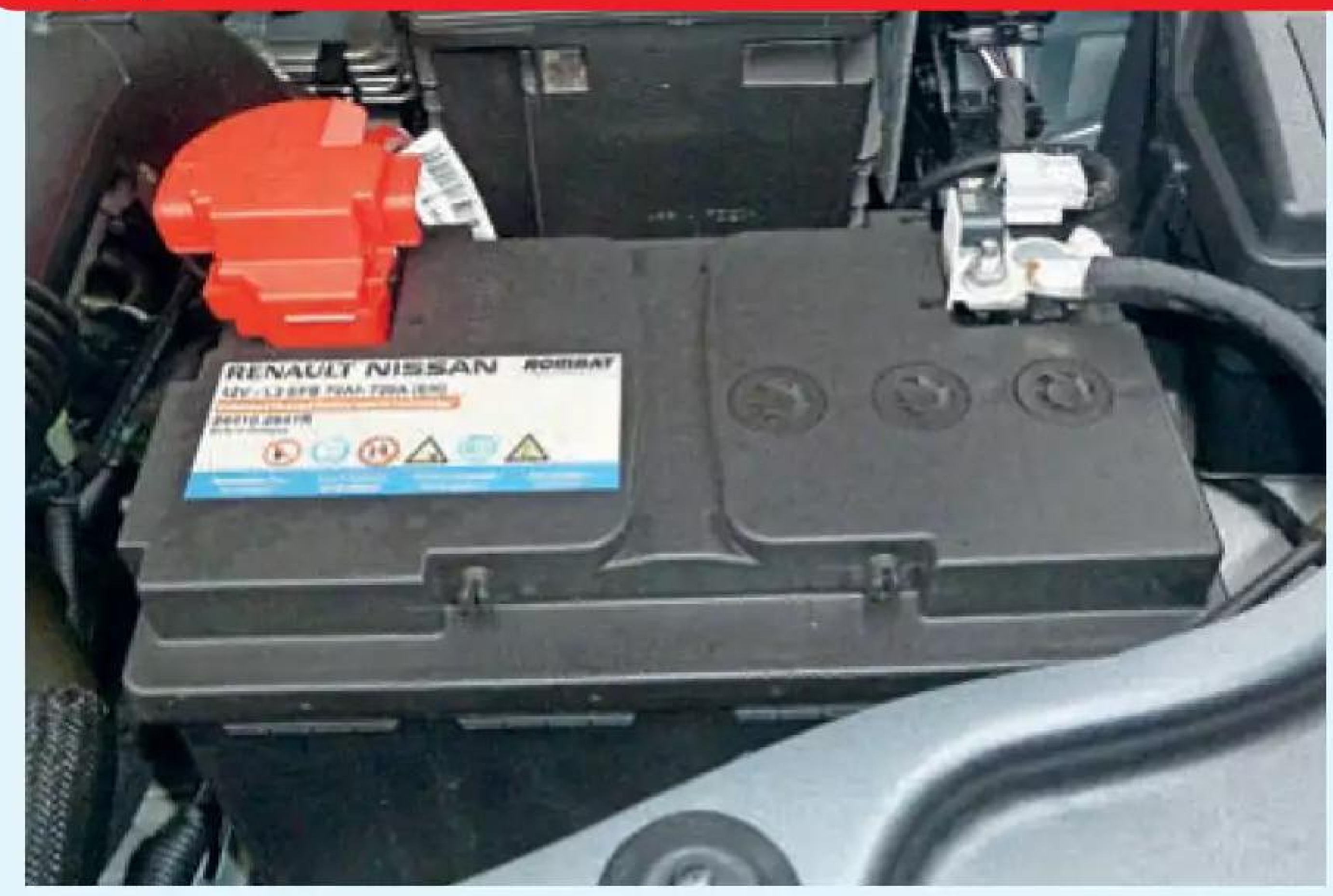
Tool of choice

▶ The Launch X431 Euro Tab II tool is an excellent machine for diagnostic assessment of this Dacia's engine management system. Although the equipment doesn't automatically recognise the Dacia Duster under that name, the operator can manually select the Duster model, gaining access to a full range of specific diagnostic procedures for the vehicle, using a general OBD approach. The tool can be switched to indicate a large number of different useful screenshots, including those showing system components/computers present around the vehicle, live data etc.

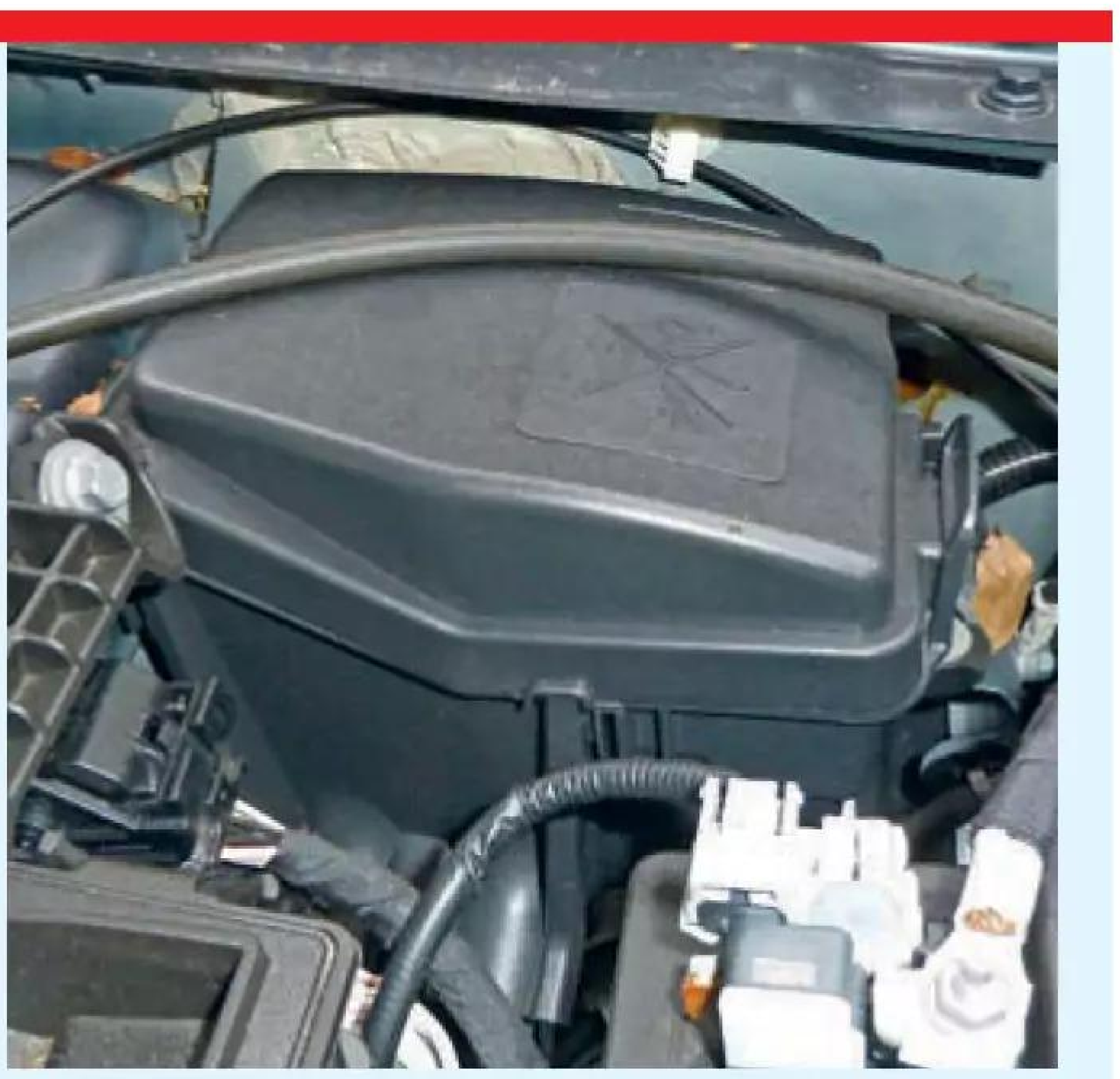
The Launch equipment can easily and rapidly be set up by the operator to control/operate individual systems and components remotely (by Bluetooth).

The Launch tool is suitable for use with a wide variety of other makes and models too.

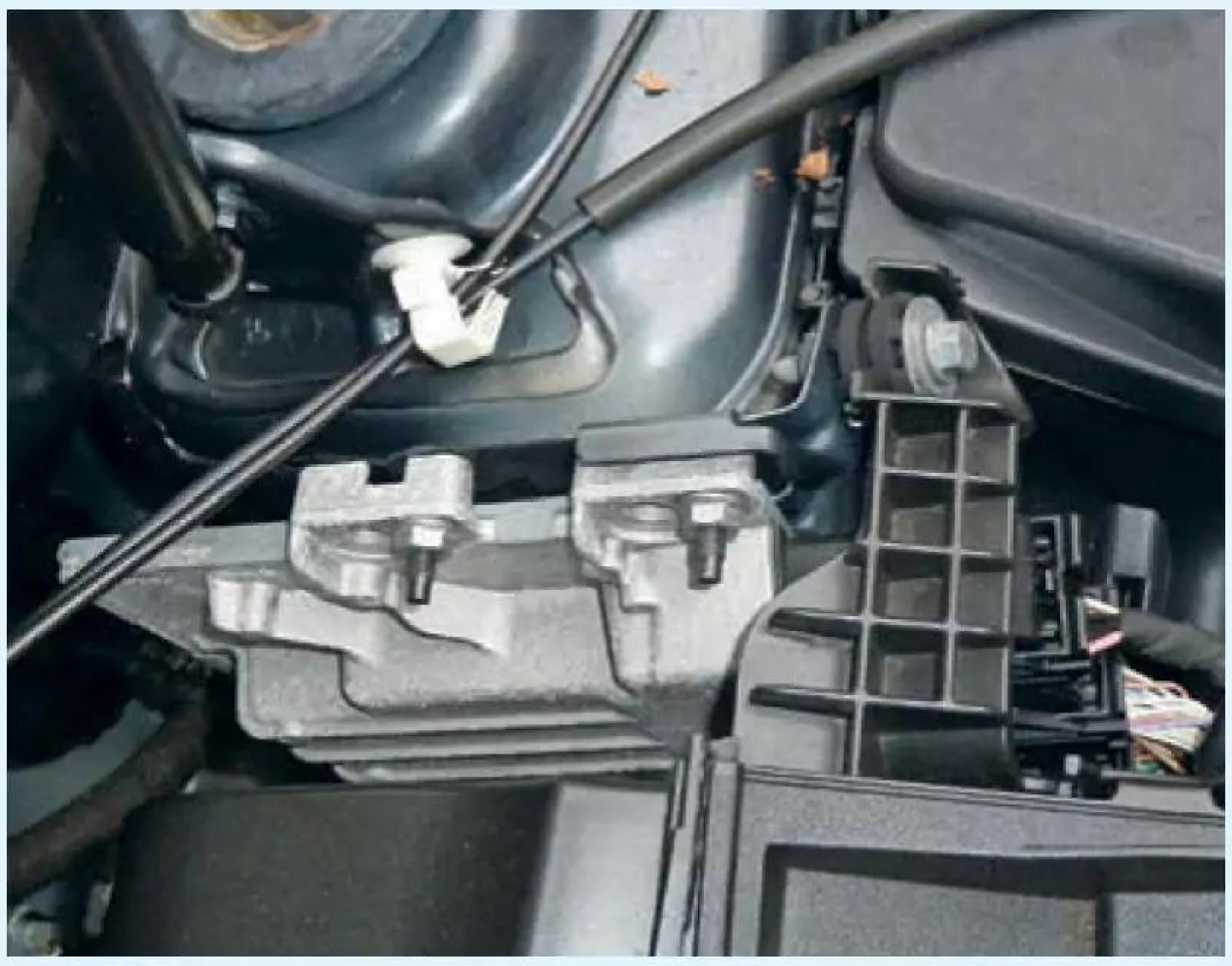
Typical Dacia Duster components



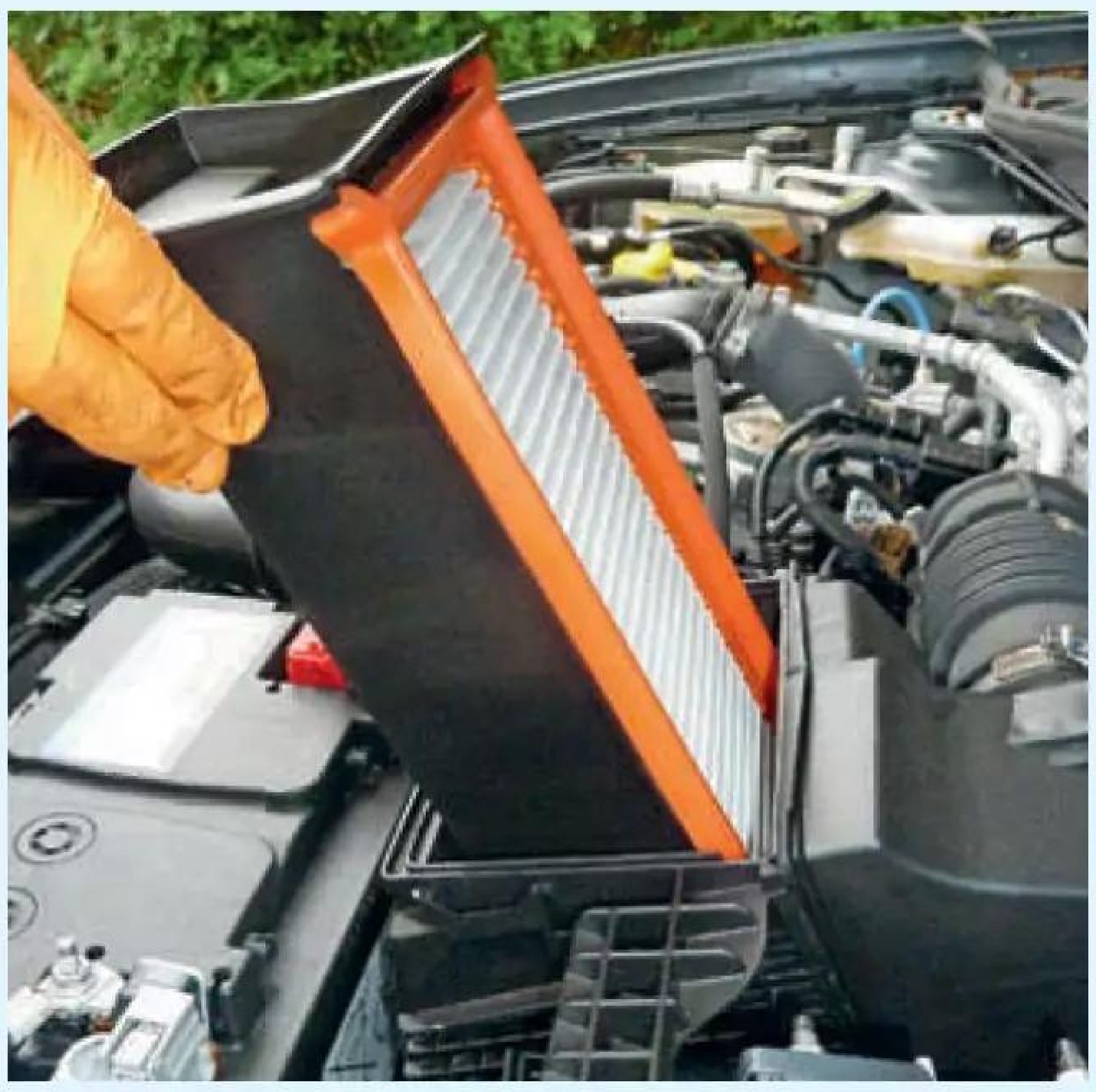
1 ◀ **The 12V battery is an enhanced flooded battery (EFB); replacements must be of the correct specification. No coding is required. The negative terminal assembly is a complex affair – treat with respect.**



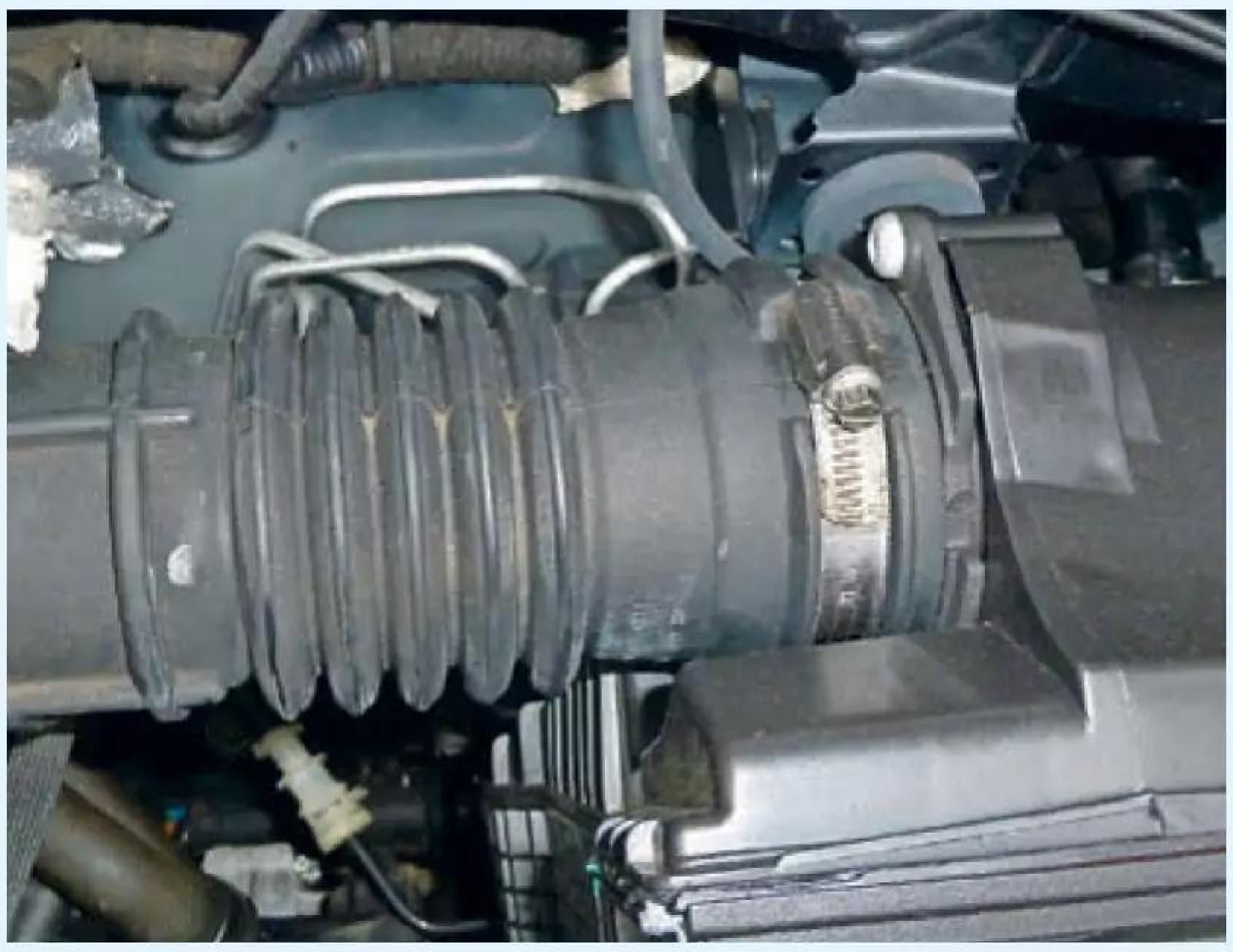
2 ▶ **The underbonnet fusebox is located just ahead of the left-hand suspension tower and adjacent to the inner wing. Check at each service that the fusebox lid is fully/snugly seated in order to keep moisture at bay.**



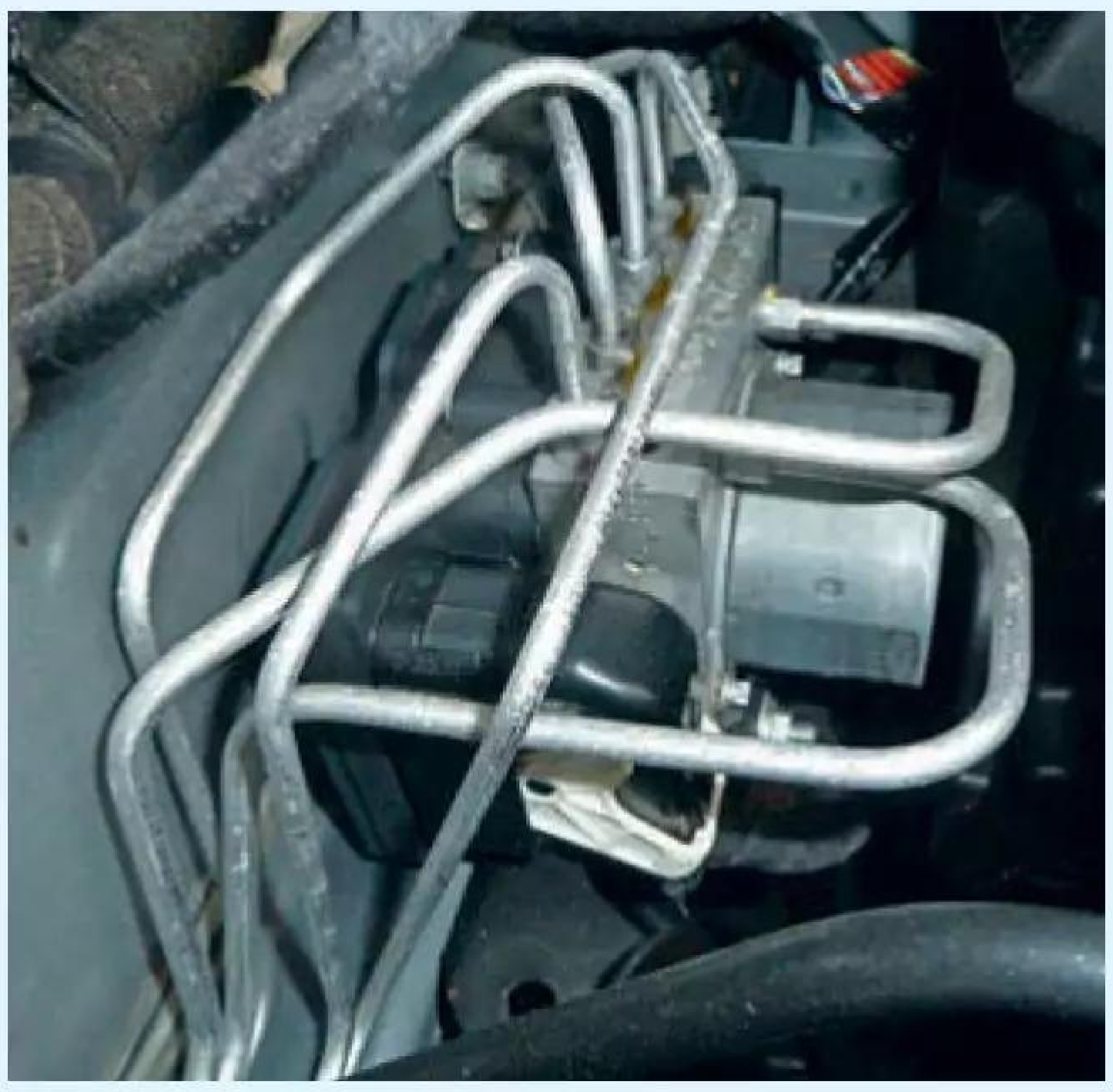
3 ◀ **Strategically located in a protected position inboard of the left-hand front suspension tower is the ECU and its associated wiring. Ensure that the cables and connections are all in good condition.**



4 ▶ **Air filter element condition is crucial to correct fuel system calibration/operation; renew at least as often as specified by Dacia, and ensure that the housing is cleaned out at the same time as renewing the filter element itself.**



5 ◀ **The intake trunking incorporates the air mass sensor, the function of which is to determine the rate (mass) of air passing through the system, signalling this to the ECU – which then determines appropriate fuelling levels.**



6 ▶ **The ABS system's control unit/ECU assembly should be inspected for evidence of deterioration and fluid leaks. A diagnostic interrogation of the ABS pump can be carried out via the Launch tool, looking at live data.**

⇨

ENGINE MANAGEMENT

This Duster incorporates these primary components:

- Multi-plug ECU.
- Control unit mounted on rear of engine ABS pump.
- Digital crankshaft and camshaft sensors.
- 4 x ignition coils.
- 4 x solenoid fuel injectors.
- Fuel cut-off inertia switch.
- Fuel pump in tank.
- Post- and pre-catalyst oxygen sensors.
- Throttle position sensor mounted on pedal and throttle body.
- MAF sensor in air filter housing.
- Engine coolant temperature sensor relaying temperature to ECU.
- Fuel pump relay, located within underbonnet fuse and relay box.

In the early stages the vehicle may have warning lights showing on the dash, and carrying out a full diagnostic check of all systems will indicate fault codes relating to battery voltage. Another sign of a battery failing is the engine Stop-Start system not working correctly.

Depending on the level of diagnostic equipment you use it can be possible to read the fault code; and not only will this show you the code but also battery voltage and time at the time of flagging the code.

Battery replacement is straightforward for any level of mechanic or do-it-yourself enthusiast… Simply disconnect the battery terminals, starting with the negative, and on fitting the new battery connect the positive terminal first.

As always, our advice is to replace the battery with a high-quality item; it needs to be the correct type of enhanced flooded battery (EFB).

No reprogramming is required, but attention to the 'window stops' will be needed, ie. raise the window glass to the top and hold the button in the 'up' position – this teaches the motor the 'one touch' end stop position.

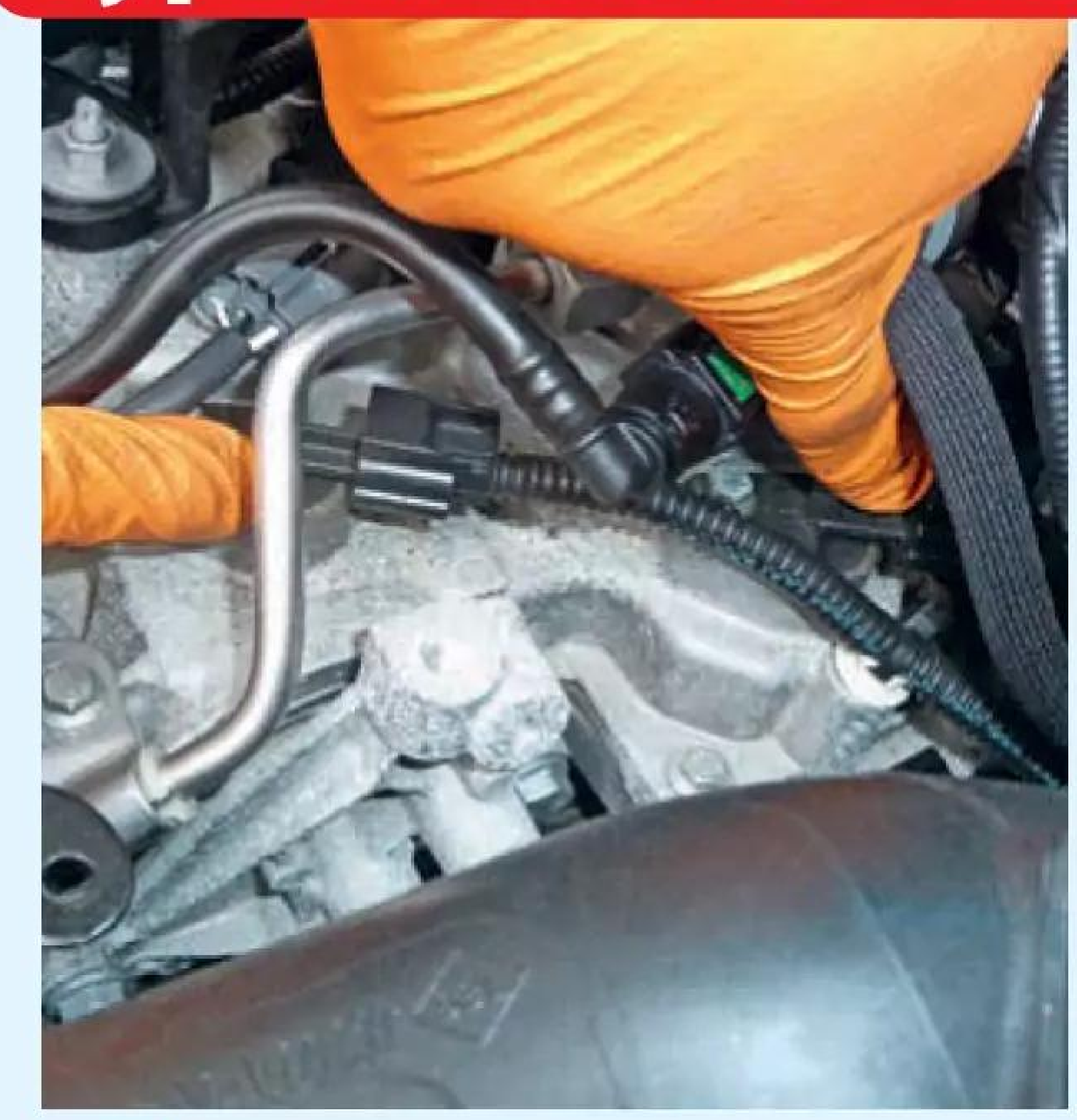
Fault 2:

FAILING MAP SENSOR

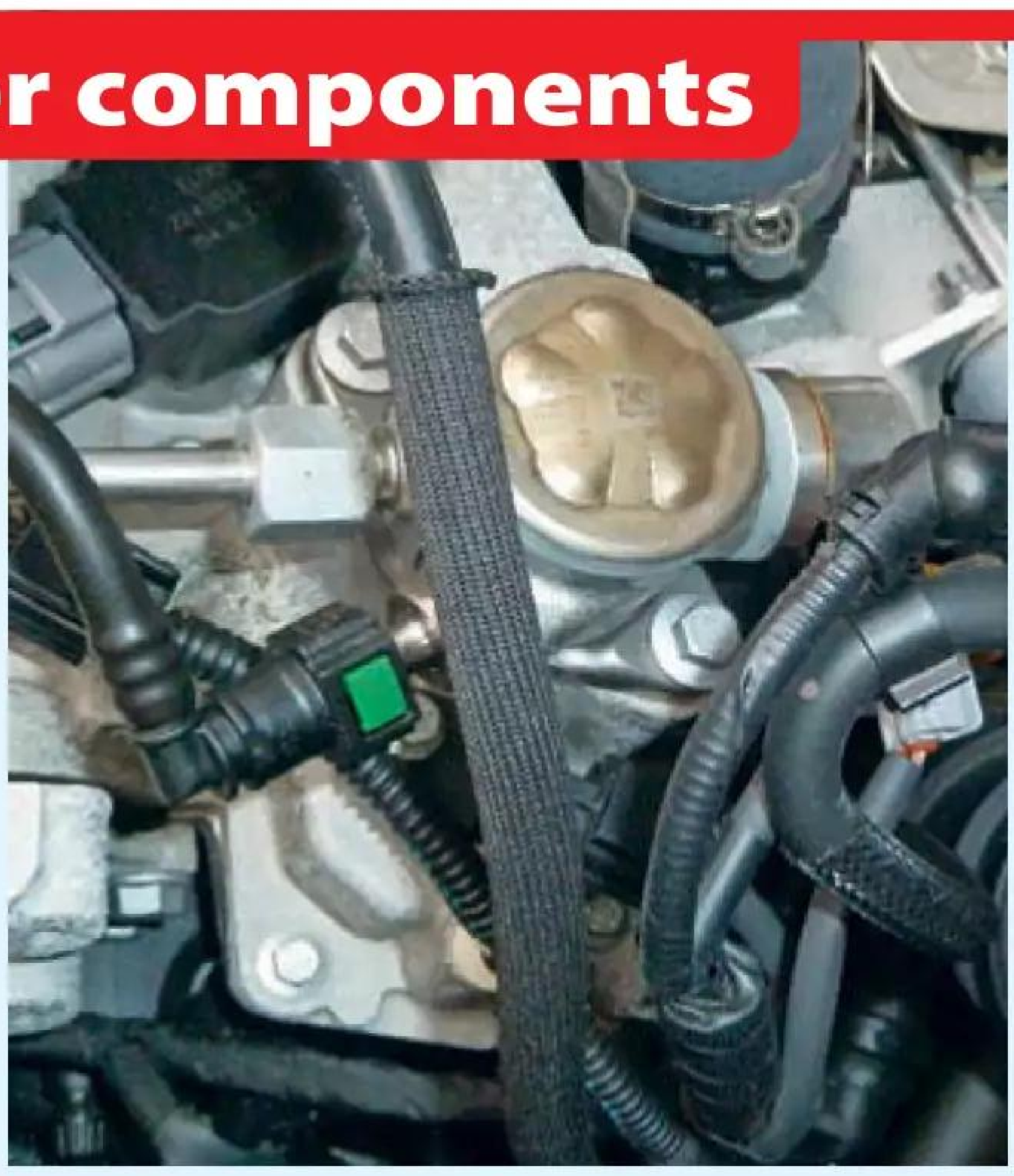
When this problem arises, symptoms will include a lack of power, probably more noticeable going up hills, and it'll be evident that the car doesn't respond as well as it should.

Carrying out a diagnostic check of the engine ECU, the operator will almost certainly see a fault code showing

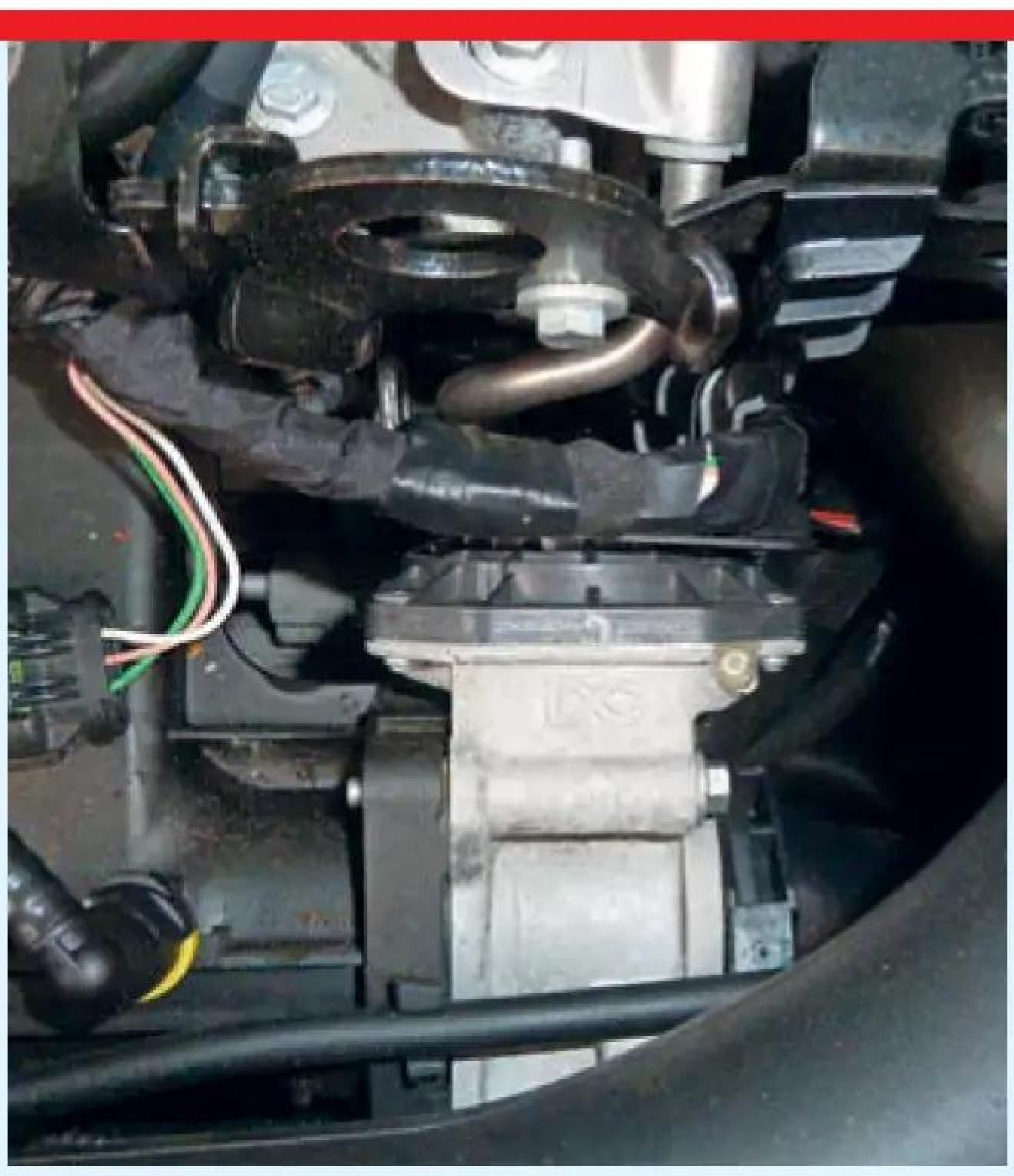
Typical Dacia Duster components



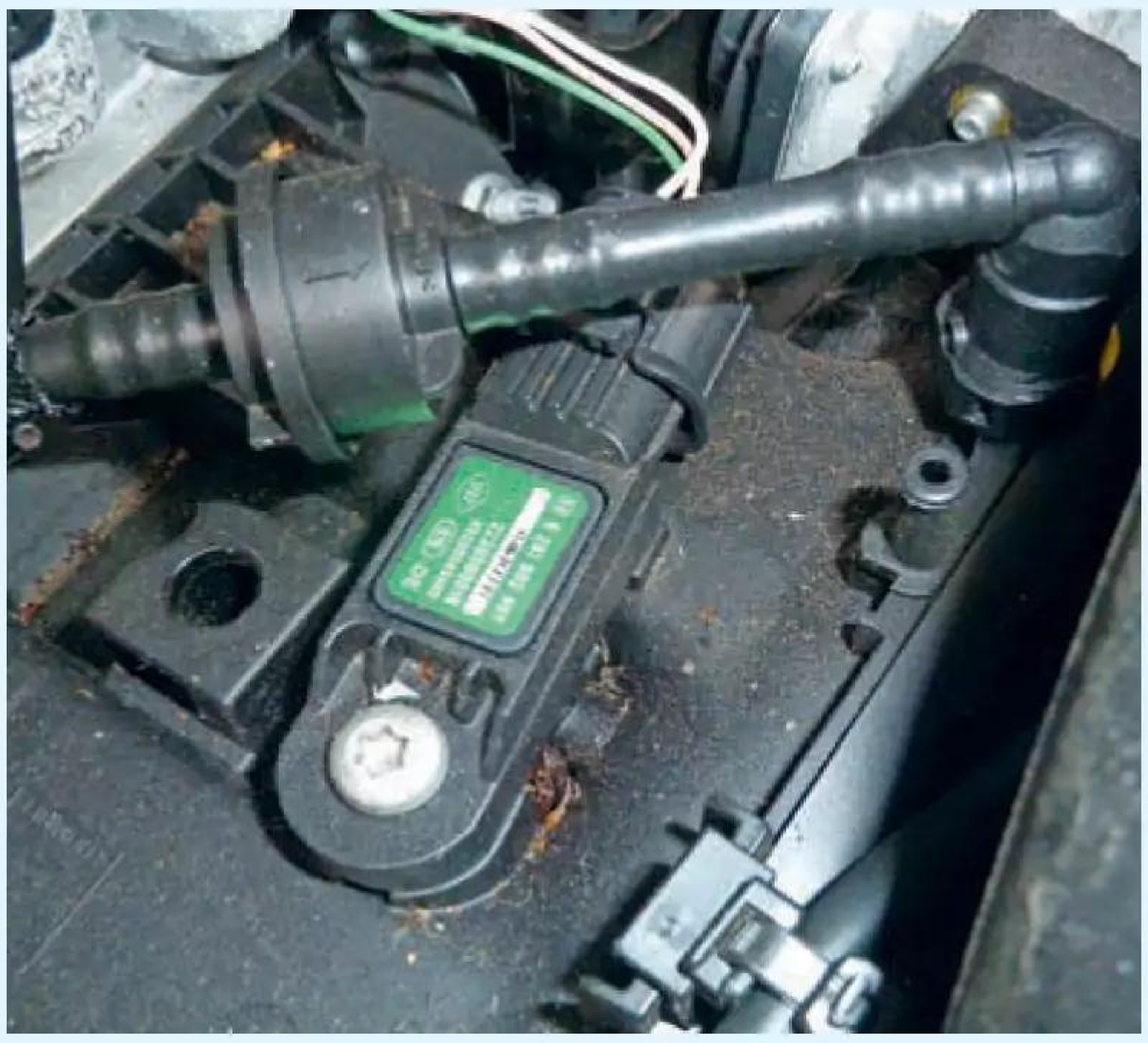
7 Crucial to engine operation are the two camshaft position sensors, being highlighted here and found at the left-hand end of the cylinder-head. They signal actual camshaft position to the ECU, enabling the system to calculate appropriate settings.



8 The very accessible high-pressure fuel pump is positioned towards the top of the engine compartment. Check for security and for signs of fuel leaks. These pumps are incredibly reliable – they are camshaft-driven and fuel pressure drop is minimal.

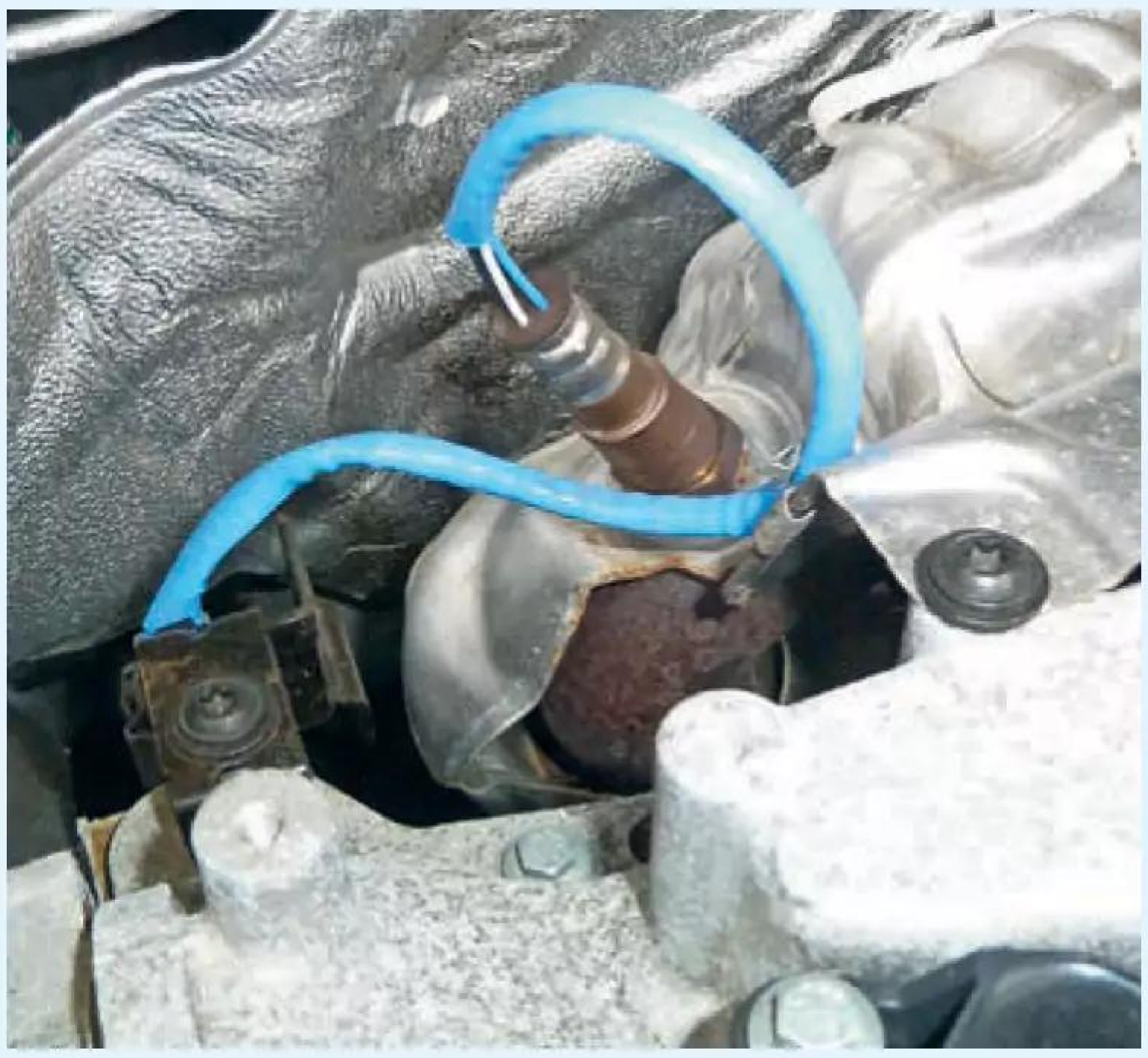


9 Viewed here from above, the throttle body assembly is located at the front of the engine bay. It's essential for effective operation that the unit is clean internally, so that the throttle flap can move easily as designed. Careful DIY cleaning is possible.



10 ◀ The MAP (manifold absolute pressure) sensor is found at the front of the engine, at the top. Its job is to provide the ECU with information regarding the pressure within the inlet manifold at any given time, enabling fuel levels to be accurately and precisely calculated.

11 ▶ Shown here is the oxygen/O2/Lambda sensor that is located high up at the rear of the engine compartment, close to the brake fluid reservoir. It is easy to reach for checking condition of wiring and connections.



'P106 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR/ BAROMETRIC PRESSURE RANGE/ PERFORMANCE PROBLEM'.

Standing at the front of the car and looking into the engine bay, the MAP sensor is literally right in front of you and held in place via a Torx 30 screw, so it's very easy and quick to reach.

It's worth checking and cleaning the MAP sensor with a 'soft' cleaner cloth at every service – you will likely see it soiled with residue from the manifold. Edward advises that in his experience all that's required is a good clean, then it's as good as new.

However, if available, you can look at live data with key on, ignition on. Looking at 'MAP sensor', you should see a minimal reading with engine off, ignition on, but when they become dirty these sensors show all sorts of readings, confusing the engine ECU in terms of manifold pressure. No coding is required if replacement is needed, just fit the new sensor and it should work!

Technical Specs

Actual values

Component	Value
Valve clearances (cold)	inlet 0.25-0.35mm; exhaust 0.46-0.54mm
Cold fuel pressure	3.5 bar
Injector resistance	14 ohms
Oxygen sensor heater circuit	3-3.5 ohms
Camshaft sensor	5-volt supply

Always opt for high-quality replacements; don't be tempted with 'bargain' components – some of which are available online. As with so many things, cheap doesn't always mean inexpensive in the long run.

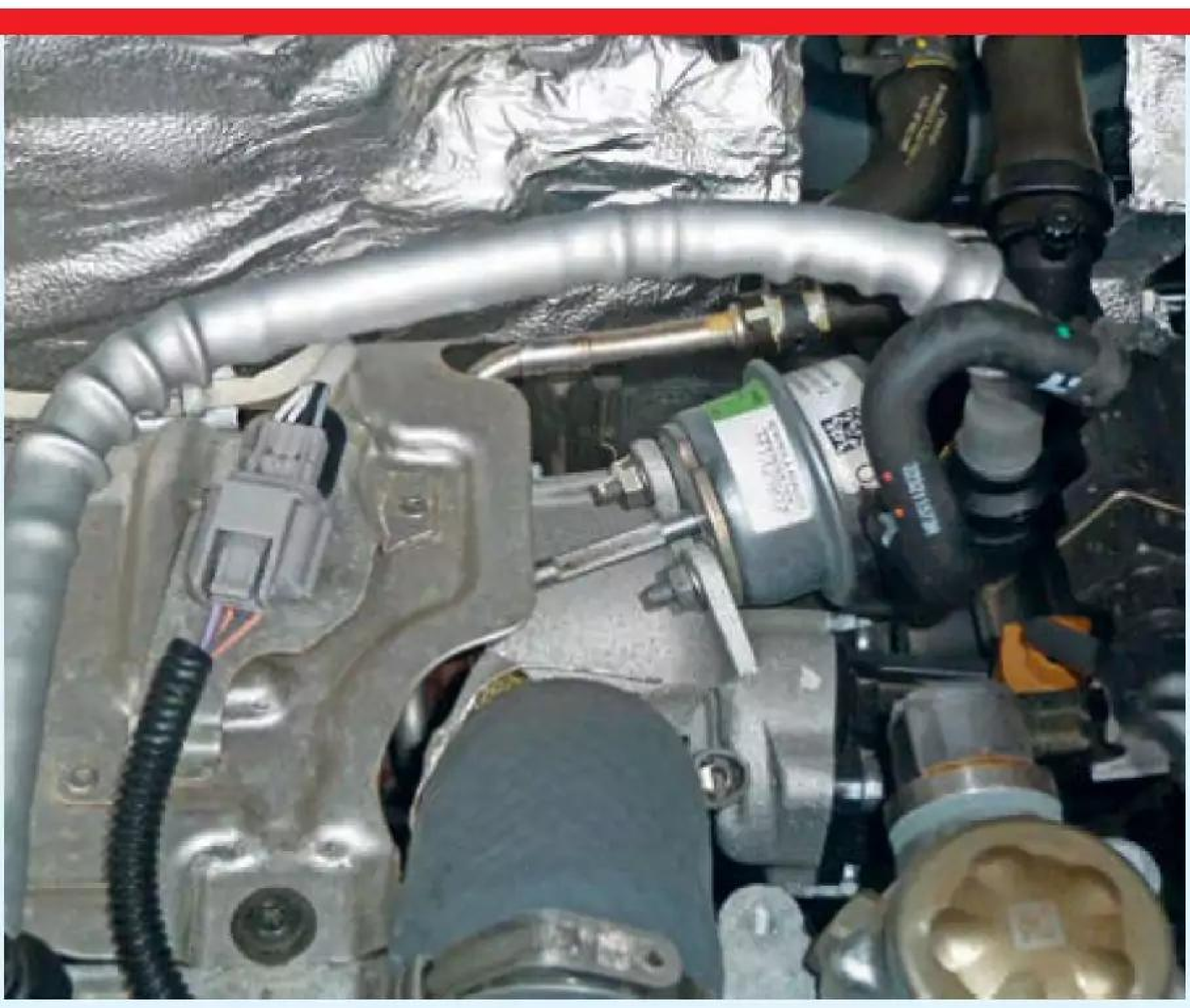
Fault 3:

ABS SENSOR PROBLEM

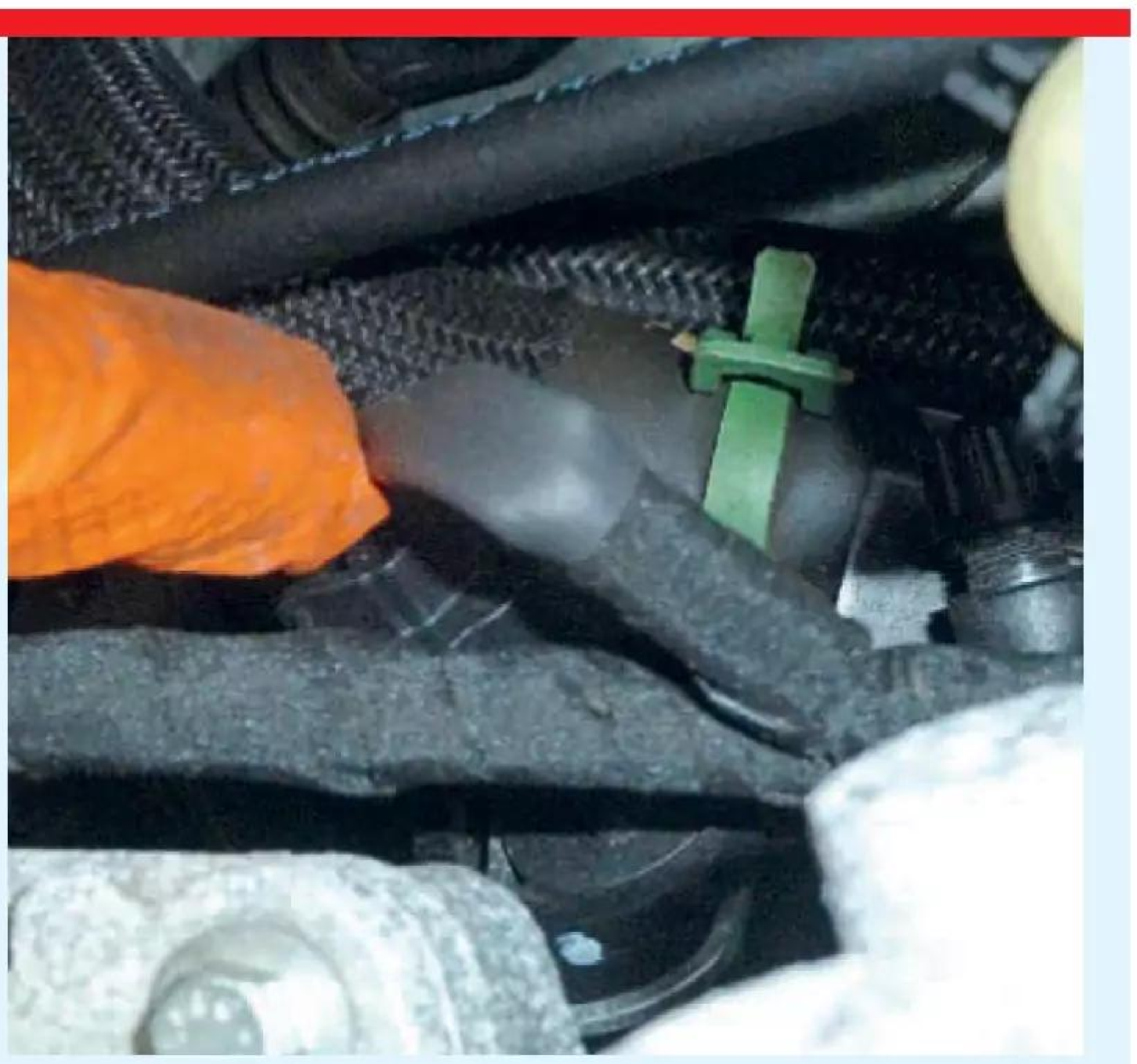
If the ABS warning light comes on, with no accompanying driving issues, carrying out a diagnostic check will show, for example, 'C0031 wheel speed sensor, left-hand front'.

Firstly, look at actual values live data, looking at all four wheels; road-test and watch for a signal being supplied. If none is evident, proceed to check the sensor for cracks or water ingress – you could swap the sensor with one from the opposite side of the car, if no oscilloscope is available. However, a 'scope', if available, will accurately measure a signal from the sensor, but of course not every garage or home mechanic has one.

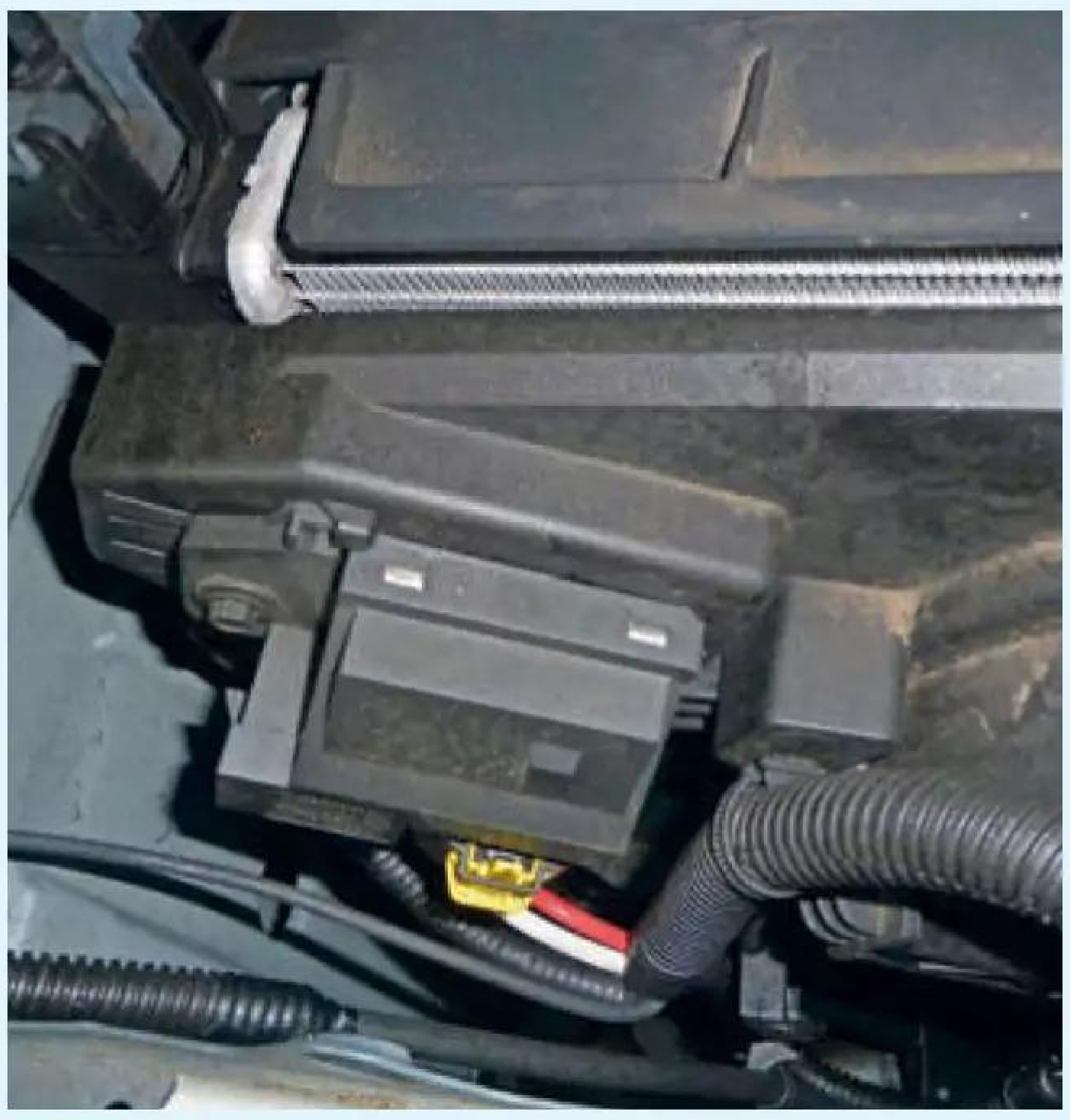
Edward advises always fitting genuine 'original equipment' quality ABS sensors – in his experience, the prices for these OE parts are competitive these days.



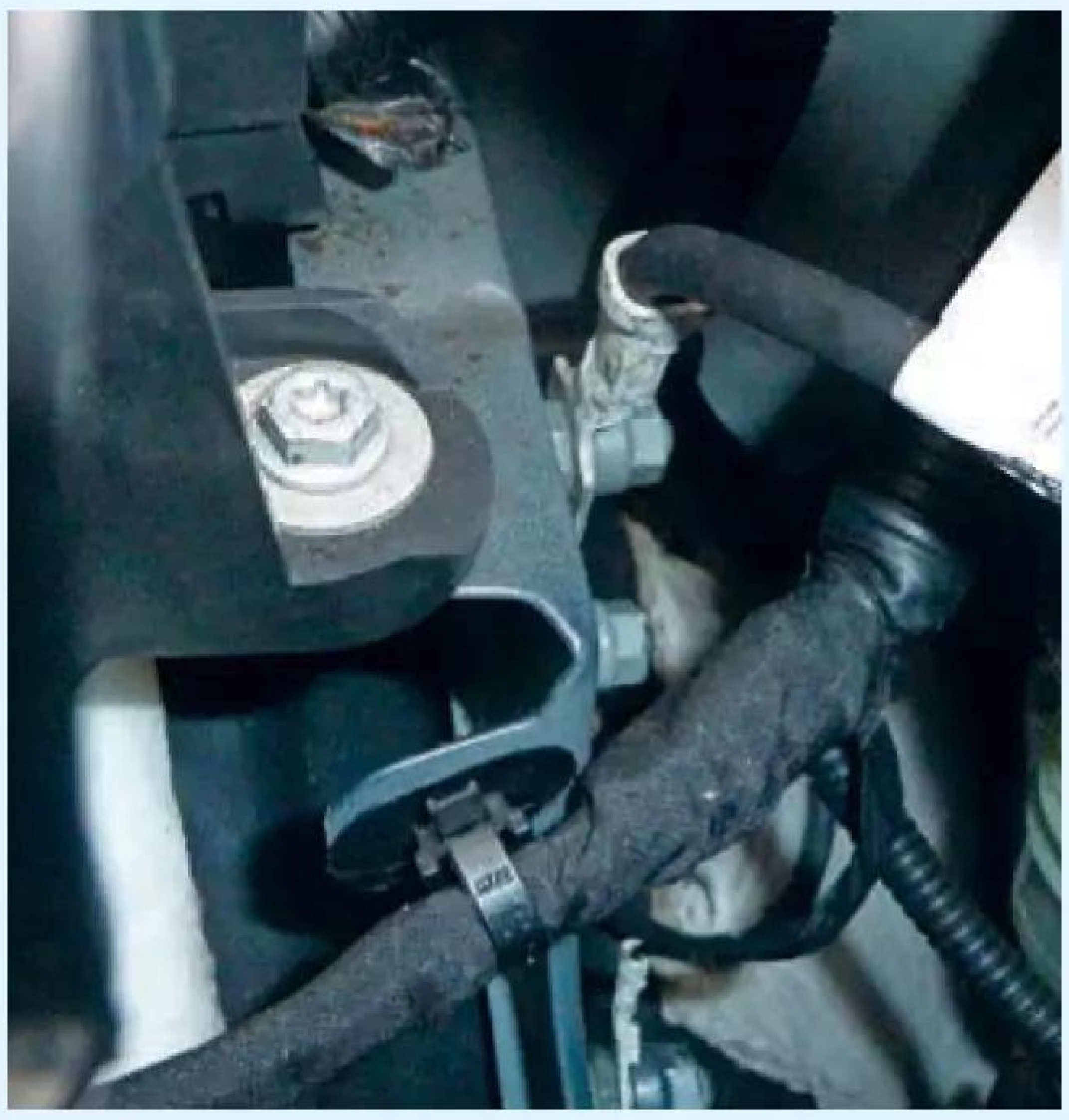
12 ◀ Visible centre stage here is the actuator rod for the turbocharger, which is positioned low down and right at the back of the engine compartment. It is essential for effective long-term turbo operation that frequent engine oil and filter changes are carried out.



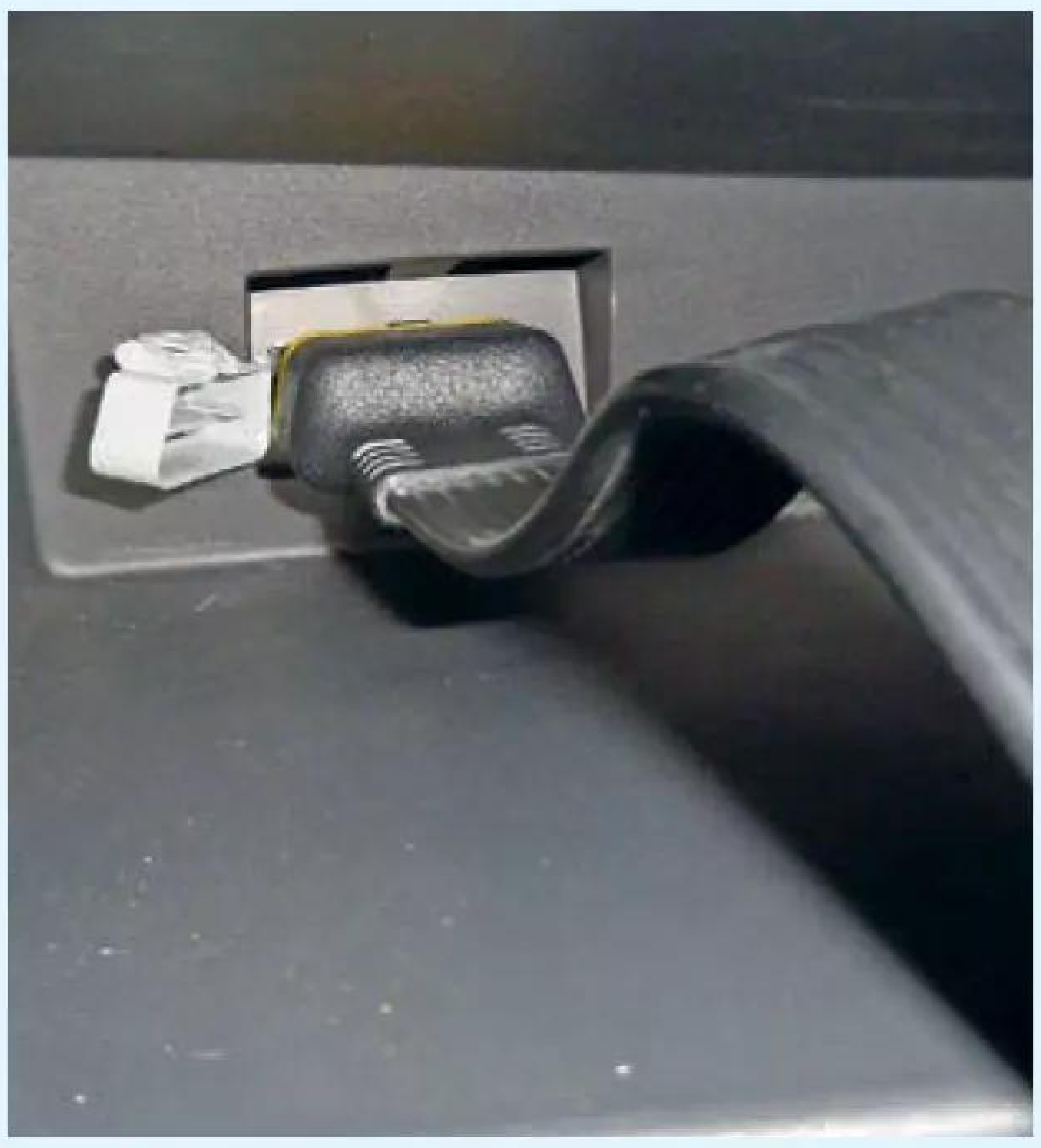
13 ▶ The coolant temperature sensor conveys vital information about engine temperature to the ECU, to enable correct fuelling parameters to be applied at all times. The sensor is attached to the thermostat housing, and buried deeply at the left-hand end of the engine.



14 Mounted on the engine's electric cooling fan assembly is the fan control unit, the effective operation of which is essential to maintaining optimum engine temperature and hence keeping performance, fuel consumption and emission levels at their most efficient.



15 Connected to the left-hand front inner wing is the vital negative earth/ ground connection point, visible in the centre of this shot. Ensure that the cable and connection are clean, in excellent condition and fully secure. If in doubt, detach/separate and clean.



16 The Duster's diagnostic socket is hidden away within the depths of the glovebox – necessitating removal of its contents in order to plug in the diagnostic equipment. This photograph shows the Launch tool's cable and plug assembly connected to the socket.

Fault 4:

STEREO SOUND SYSTEM PLAYING-UP

Again, this difficulty affects Renaults as well as Dacias – the stereo unit fails but in a variety of different ways. Edward has experienced units that won't switch on, or with the volume control not operating, or even pixels failing on the screen. Realistically these units are not fixable and new replacements from dealers are very expensive so he recommends going down the quality-aftermarket route. The unit is easy to change – pull the outer trim away and release/remove the four Torx screws.

USEFUL PREPARATION DATA

Here are the official recommended change intervals for the various components. However, Edward advises that these service/change intervals are at least halved.

Engine oil Every 12,000 miles or 12 months, whichever comes first.

Oil Type SAE 5W-30 fully synthetic A3/B4, A5 – use only the Dacia recommended specification oil.

Capacity ('service' fill) 4.7 litres.

Sump plug torque setting 50Nm.

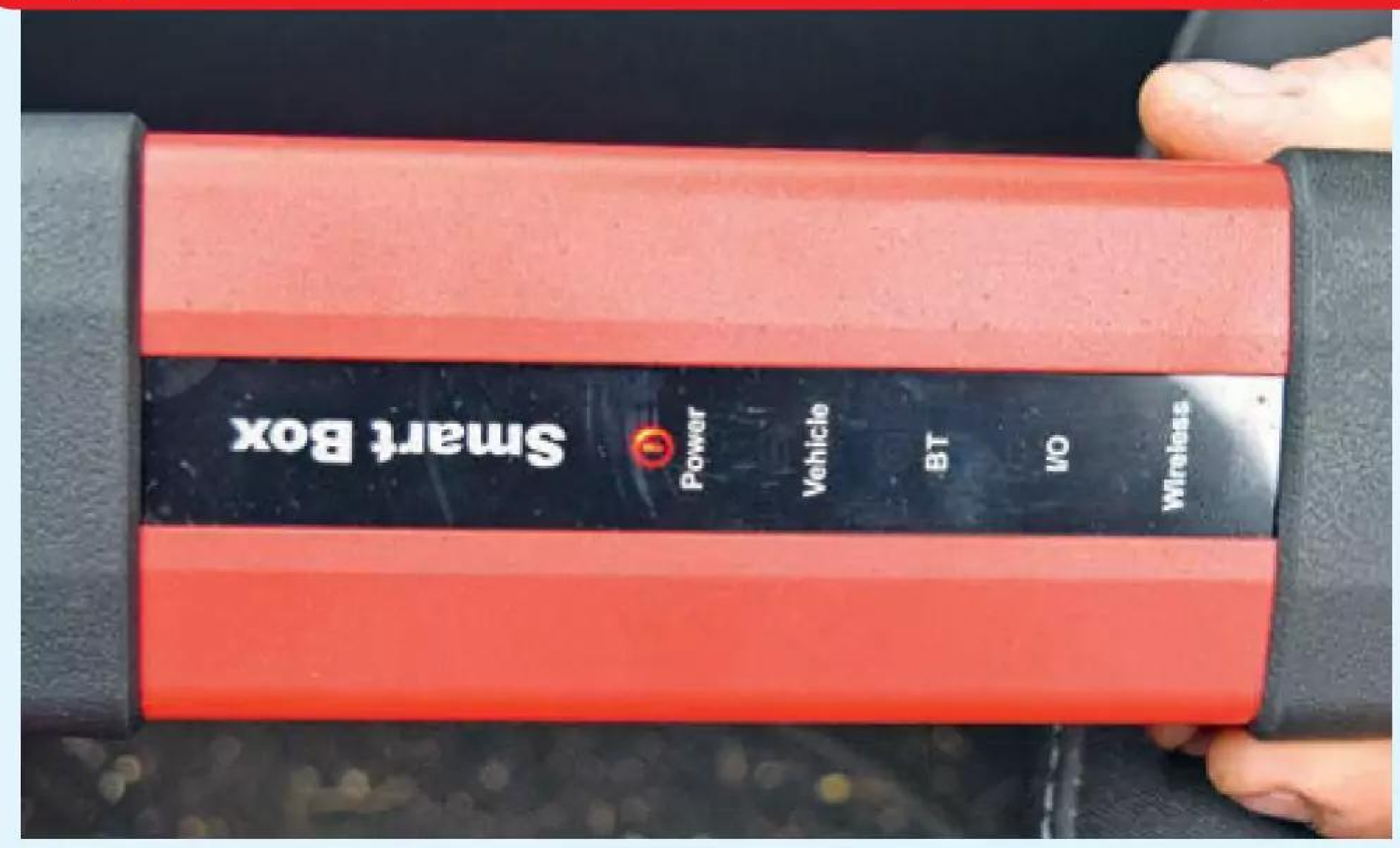
Spark plugs Officially renew every 36,000 miles or 48 months, whichever comes first.

Firing order 1-3-4-2.

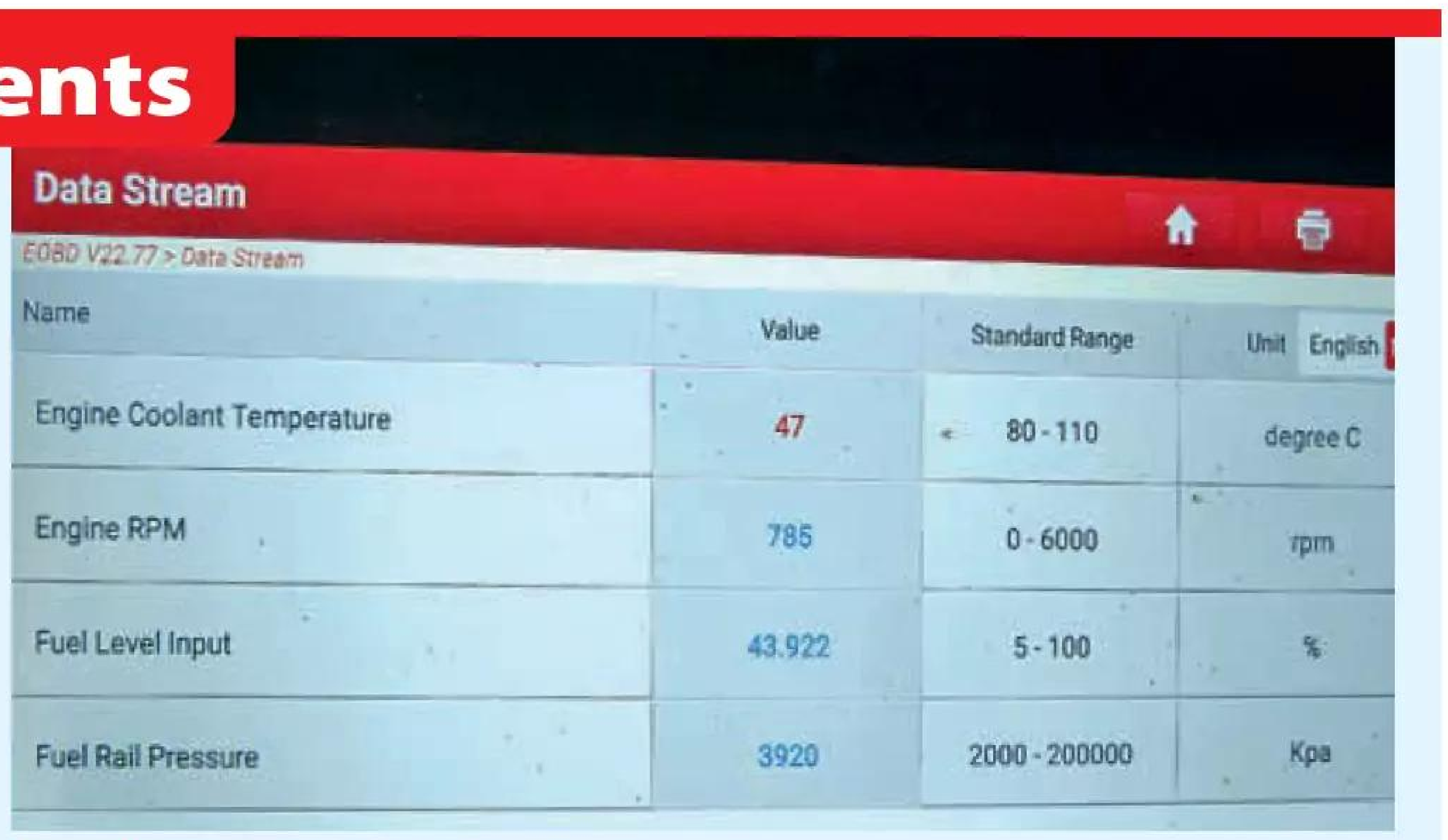
Air filter Officially renew every 36,000 miles or 48 months, whichever comes first.

Brake fluid Every 24 months.

Typical Dacia Duster components



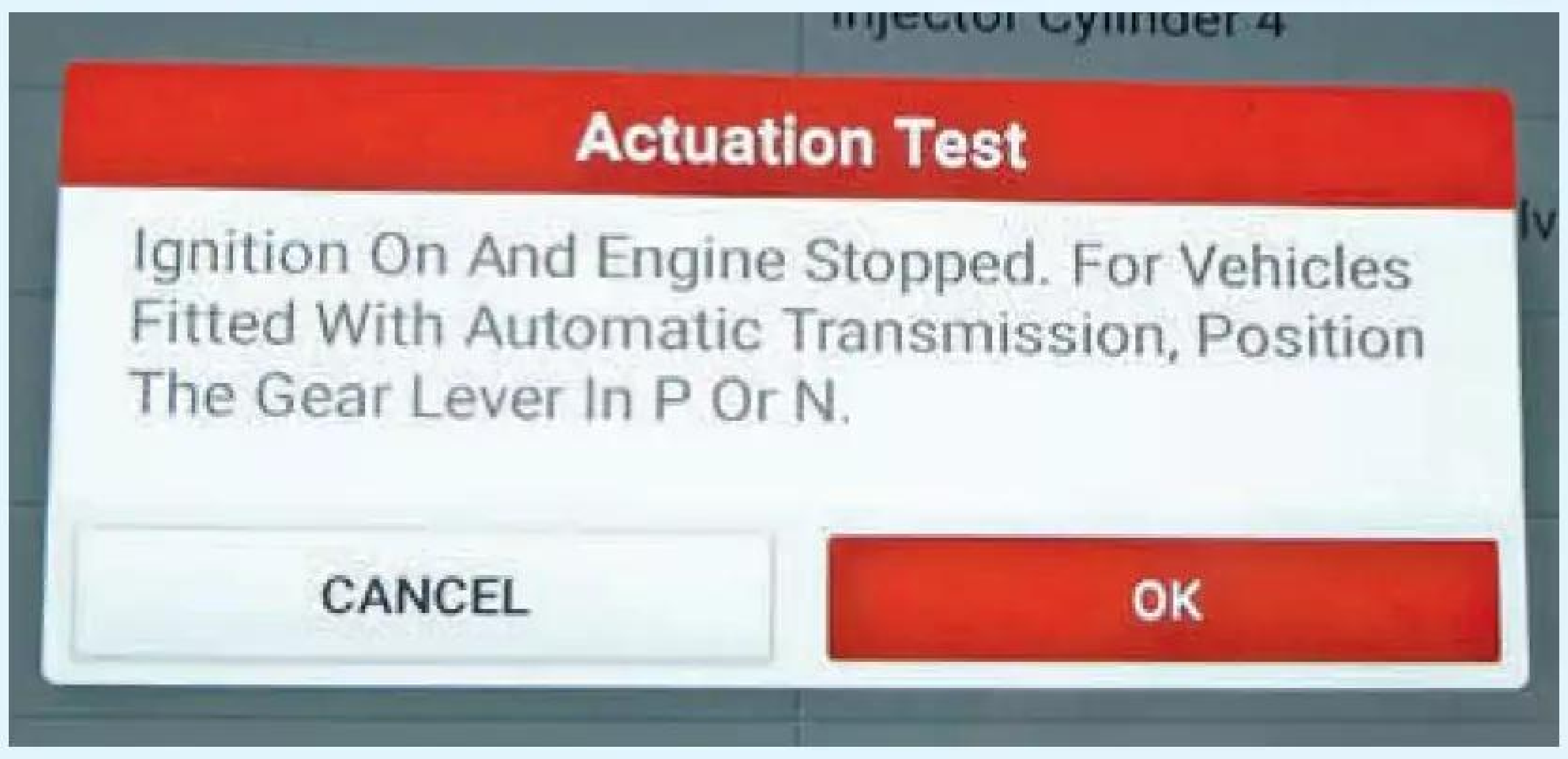
17 The Launch X431 Euro Tab II tool is compact yet very comprehensive and wide-ranging in its scope and abilities, and is seen here powered up and ready to conduct in-depth system interrogation when connected to the Dacia's diagnostic socket.



EOBD V22.77 > Data Stream

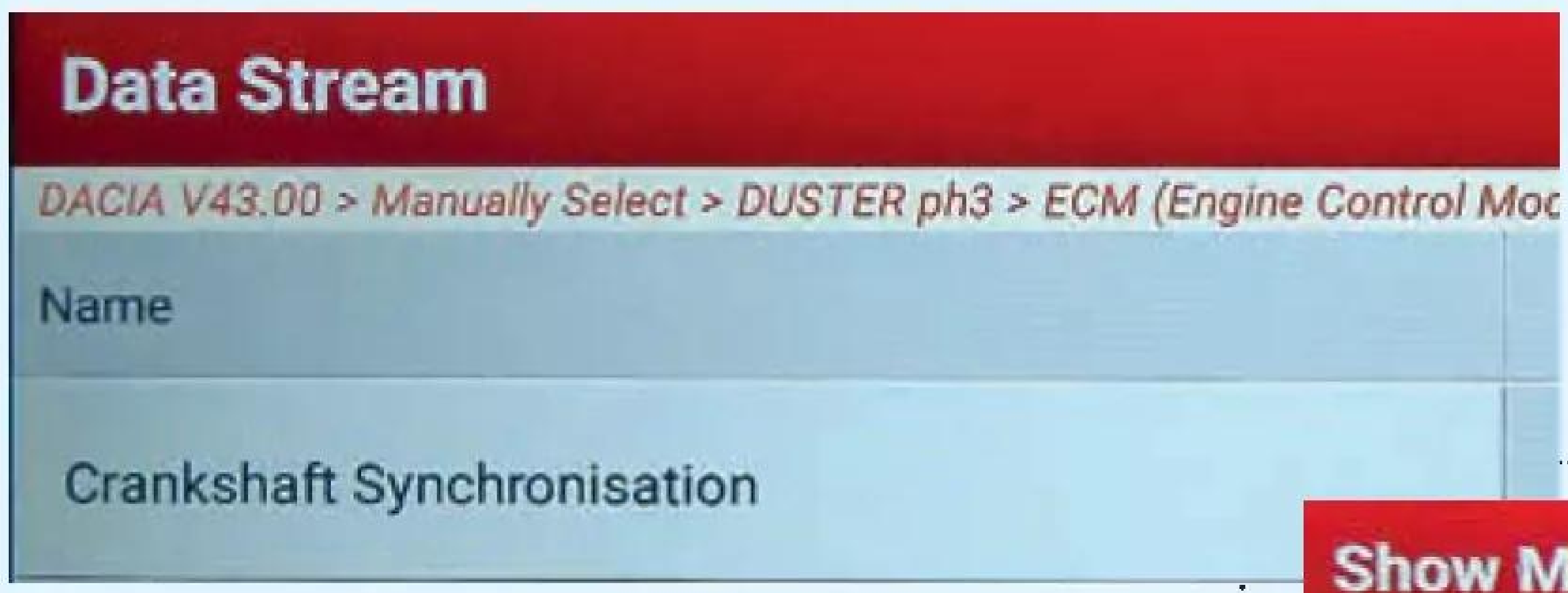
Name	Value	Standard Range	Unit English
Engine Coolant Temperature	47	80 - 110	degree C
Engine RPM	785	0 - 6000	rpm
Fuel Level Input	43.922	5 - 100	%
Fuel Rail Pressure	3920	2000 - 200000	Kpa

18 For this Dacia, the tool requires the operator to manually select the Duster model, then the full range of diagnostic interrogation procedures is brought into play. This screenshot is displaying live data relating to engine and fuel system functions.



Ignition On And Engine Stopped. For Vehicles Fitted With Automatic Transmission, Position The Gear Lever In P Or N.

19 ◀ Actuator tests can be applied by the operator using the Launch tool, so that specific components and systems can be test-operated directly via the machine. This valuable facility helps pinpoint problems (the operator can check if the various components are working as they should), saving time during diagnostic work on the car. For example, with regard to the cooling system, the operator can use the tool to 'drive' the electric fan, proving that the fan wiring etc., is functioning as designed, and thus making diagnostic work much easier.

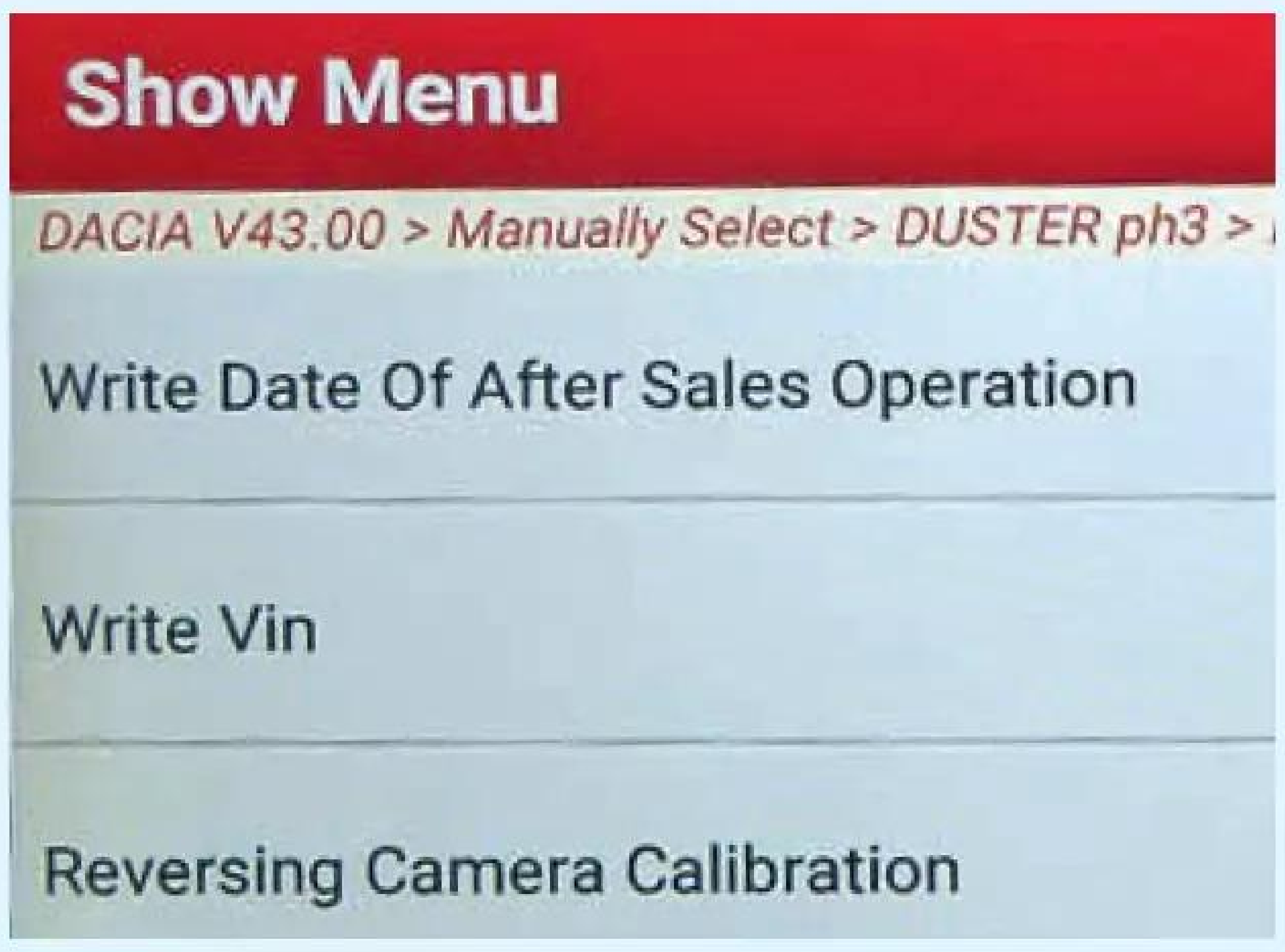


DACIA V43.00 > Manually Select > DUSTER ph3 > ECM (Engine Control Moc

Name

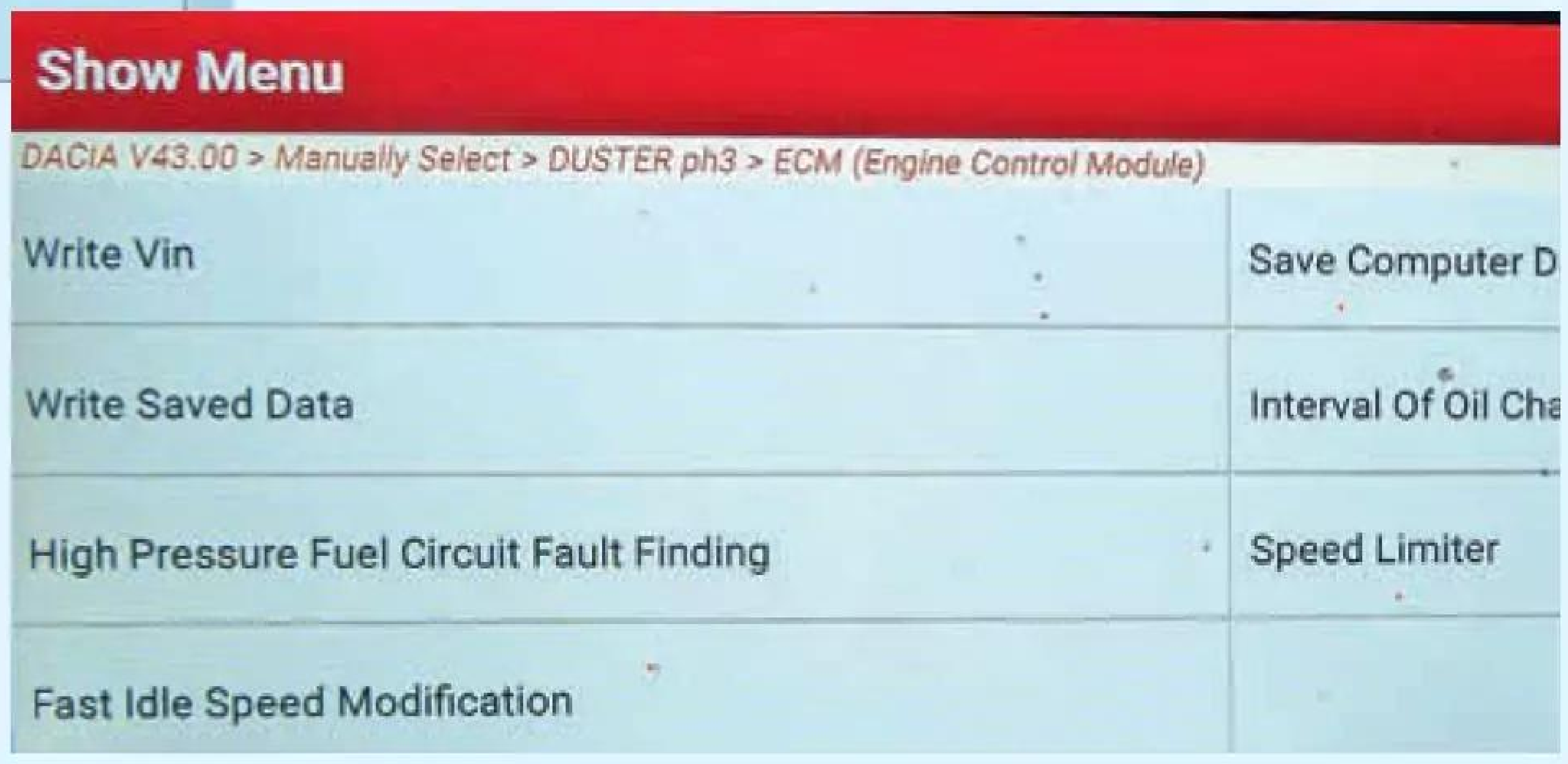
Crankshaft Synchronisation

20 ▲ This live data screenshot confirms that crankshaft synchronisation is correct; such information is invaluable to the operator. Edward advises that the Launch tool is excellent in providing this function, to ensure that the signals from the crankshaft and camshaft sensors are in sync. So if, for example, the timing chain has stretched, you could see a fault flagged up. Not many diagnostic machines offer this facility, so well done to Launch.


Show Menu
Write Date Of After Sales Operation
Write Vin
Reversing Camera Calibration

DACIA V43.00 > Manually Select > DUSTER ph3 >

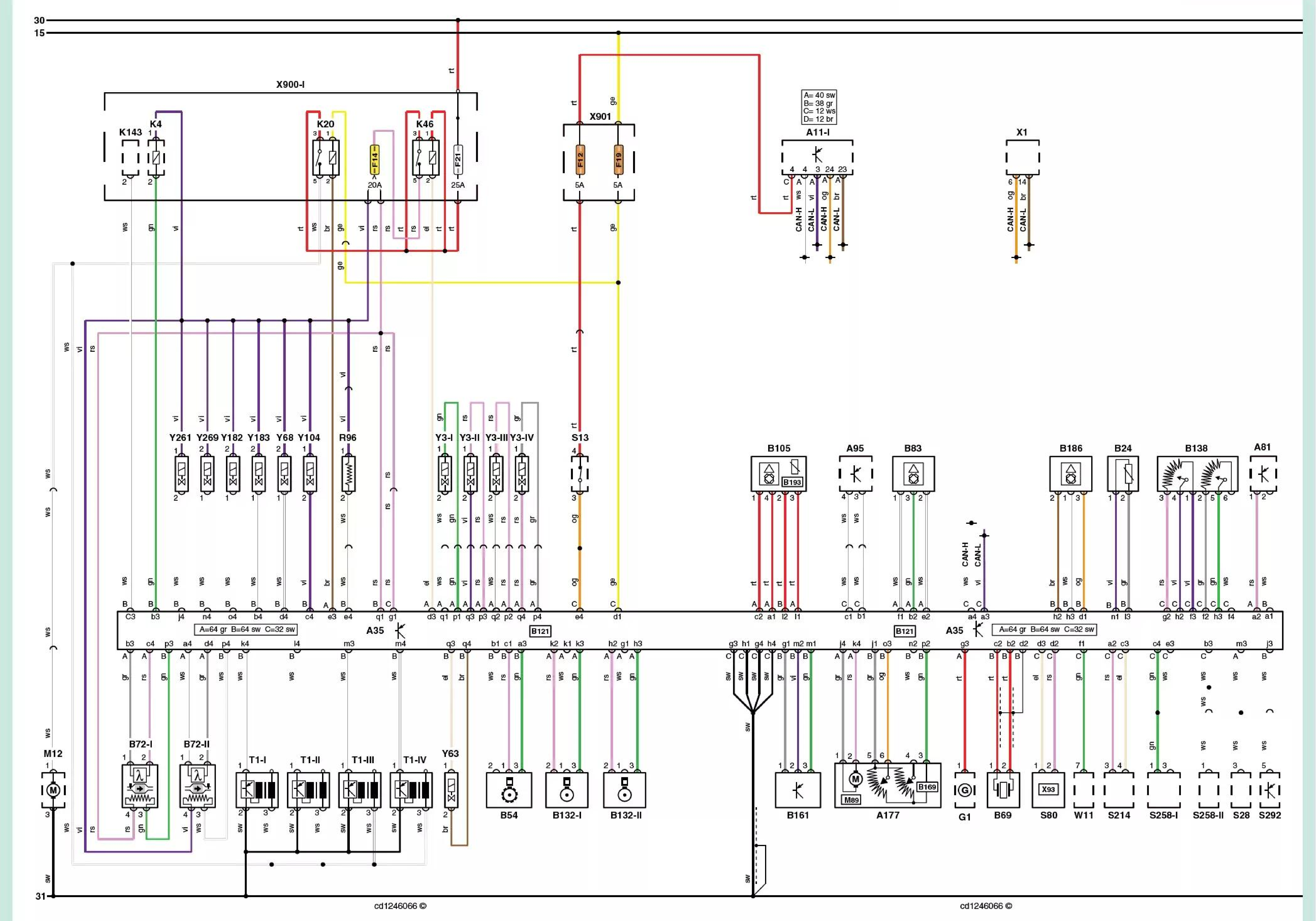
21 ▲ One of the many useful functions of the Launch X431 Euro Tab II tool is enabling the operator to calibrate the reversing camera. This facility is another useful feature of the Launch tool, and works on other systems too. If the operator removes a component or disconnects it, a calibration is required, and the Launch tool facilitates this.



DACIA V43.00 > Manually Select > DUSTER ph3 > ECM (Engine Control Module)

22 ◀ A variety of special functions are available using the Launch X431 Euro Tab II tool, including the facility enabling the operator to directly control operation of the vehicle's various systems. This screenshot shows aspects relating directly to the engine control module.

DACIA DUSTER CIRCUIT DIAGRAM


30
15
31
X900-I
K143
K4
K20
K46
F14
20A
F21
25A
X901
F12
F19
5A
A11-I
A= 40 sw
B= 38 gr
C= 12 ws
D= 12 br
X1
CAN-H
CAN-L
Y261
Y269
Y182
Y183
Y68
Y104
R96
Y3-I
Y3-II
Y3-III
Y3-IV
S13
B105
B193
A95
B83
B186
B24
B138
A81
A35
B121
A=64 gr B=64 sw C=32 sw
M12
B72-I
B72-II
T1-I
T1-II
T1-III
T1-IV
Y63
B54
B132-I
B132-II
B161
A177
M89
B169
G1
B69
S80
X93
W11
S214
S258-I
S258-II
S28
S292
cd1246066 ©

CODE	COMPONENT DESCRIPTION
A11-I	MULTIFUNCTION CONTROL MODULE | 1
A35	ENGINE CONTROL MODULE (ECM)
A81	POWER STEERING CONTROL MODULE
A95	ENGINE COOLANT BLOWER MOTOR CONTROL MODULE
A177	THROTTLE CONTROL UNIT
B24	ENGINE COOLANT TEMPERATURE (ECT) SENSOR
B54	CRANKSHAFT POSITION (CKP) SENSOR
B69	KNOCK SENSOR (KS)
B72-I	HEATED OXYGEN SENSOR (HO2S) | 1
B72-II	HEATED OXYGEN SENSOR (HO2S) | 2
B83	MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR
B105	TURBOCHARGER (TC) BOOST PRESSURE SENSOR
B121	BAROMETRIC PRESSURE (BARO) SENSOR
B132-I	CAMSHAFT POSITION (CMP) SENSOR | 1
B132-II	CAMSHAFT POSITION (CMP) SENSOR | 2
B138	ACCELERATOR PEDAL POSITION (APP) SENSOR
B161	AC REFRIGERANT PRESSURE SENSOR
B169	THROTTLE MOTOR POSITION SENSOR
B186	FUEL RAIL PRESSURE (FRP) SENSOR
B193	TURBOCHARGER/SUPERCHARGER (TC/SC) BOOST AIR TEMPERATURE SENSOR
CAN-H	CONTROLLER AREA NETWORK (DATA BUS) HIGH
CAN-L	CONTROLLER AREA NETWORK (DATA BUS) LOW
F	FUSE
G1	ALTERNATOR
K4	STARTER MOTOR RELAY
K20	FUEL PUMP (FP) RELAY
K46	ENGINE CONTROL (EC) RELAY
K143	AC COMPRESSOR CLUTCH RELAY
M12	FUEL PUMP (FP)
M89	THROTTLE MOTOR
R96	ENGINE COOLANT THERMOSTAT
S13	BRAKE PEDAL POSITION (BPP) SWITCH
S28	REVERSE GEAR POSITION SWITCH
S80	CRUISE CONTROL SELECTOR SWITCH
S214	CRUISE CONTROL REVERSING SWITCH
S258-I	CLUTCH PEDAL POSITION (CPP) SWITCH | 1
S258-II	CLUTCH PEDAL POSITION (CPP) SWITCH | 2
S292	AC/HEATER FUNCTION CONTROL PANEL
T1-I	IGNITION COIL | 1
T1-II	IGNITION COIL | 2
T1-III	IGNITION COIL | 3
T1-IV	IGNITION COIL | 4
W11	SPARE CABLE
X1	DATA LINK CONNECTOR (DLC)
X93	AIRBAG SPIRAL CABLE
X900-I	FUSE BOX/RELAY PLATE, ENGINE BAY 1
X901	FUSE BOX/RELAY PLATE, FASCIA
Y3-I	INJECTOR | 1
Y3-II	INJECTOR | 2
Y3-III	INJECTOR | 3
Y3-IV	INJECTOR | 4
Y63	FUEL PRESSURE REGULATOR CONTROL SOLENOID
Y68	TURBOCHARGER (TC) WASTEGATE REGULATING VALVE
Y104	EVAPORATIVE EMISSION (EVAP) CANISTER PURGE VALVE
Y182	CAMSHAFT POSITION (CMP) ACTUATOR, INTAKE
Y183	CAMSHAFT POSITION (CMP) ACTUATOR, EXHAUST
Y261	TURBOCHARGER (TC) BOOST AIR DIVERT VALVE
Y269	ENGINE OIL PUMP CONTROL VALVE
15	IGNITION SWITCH - IGNITION ON
30	BATTERY +
31	BATTERY -

Electronic Diagnostics

PEUGEOT 208 1.2 PETROL

Tracing and fixing faults in electronic engine management systems

One of the 'new breed' of Peugeots, the 208 'Supermini' has become a family favourite for many. **Kim Henson** and **Edward Haggar** explore the diagnostic intricacies of a three-cylinder petrol-powered example.

Launched at the Geneva Motor Show in 2012, the freshly-styled 208 replaced the outgoing 207, and was said to be lighter, more spacious and more fuel-efficient than its predecessor, and with lower exhaust emission levels.

A variety of petrol and diesel engines was offered, and for this feature we are looking at a three-cylinder 1.2-litre 208, dating from October 2012, bearing engine code HMZ – also used in a variety of other PSA Group Peugeot and Citroën vehicles.

Advantages claimed by the PSA Group for their three-cylinder engines, compared with four-cylinder units, include lighter weight, increased fuel efficiency and better emissions performance – plus lower levels of friction within the motor.

Note: All references in our text and captions to 'left' and right' sides are from the point of view of someone sitting in the car and looking ahead.

Preparation

These Peugeots are extremely easy for the home mechanic to work on, with excellent underbonnet accessibility.

Edward adds that, based on his own experience of having owned one, they are amazing around town, yet pretty much great for motorway cruising.

From a diagnostic point of view a basic code reader will enable you to easily access the engine management system.

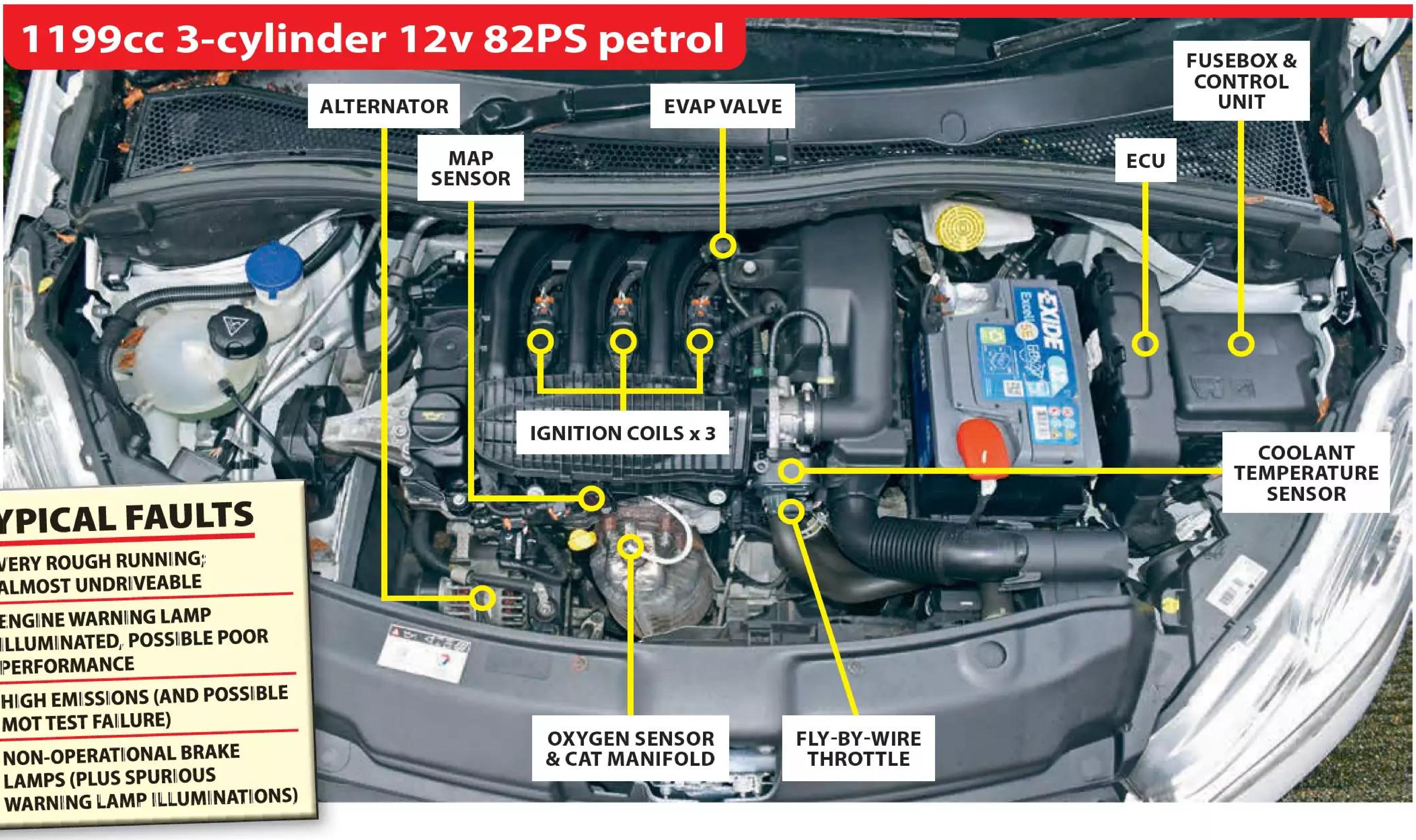
Resetting the service indicator lamp is simply a case of holding down the button on the dash, turning the ignition on and watching the counter reset from 10.

Edward says that for anyone thinking of buying a modern car and maintaining it themselves, he would encourage them to think about one of these 208s.

Fault 1:

FAILING FUEL INJECTOR(S)

When this problem occurs, the car will be running very roughly indeed, with the engine warning lamp illuminated,



1199cc 3-cylinder 12v 82PS petrol

TYPICAL FAULTS

1. VERY ROUGH RUNNING; ALMOST UNDRIVEABLE
2. ENGINE WARNING LAMP ILLUMINATED, POSSIBLE POOR PERFORMANCE
3. HIGH EMISSIONS (AND POSSIBLE MOT TEST FAILURE)
4. NON-OPERATIONAL BRAKE LAMPS (PLUS SPURIOUS WARNING LAMP ILLUMINATIONS)

and as the engine has only three cylinders, the vehicle will be virtually undriveable. The trouble is due to failure of one or more of the fuel injectors.

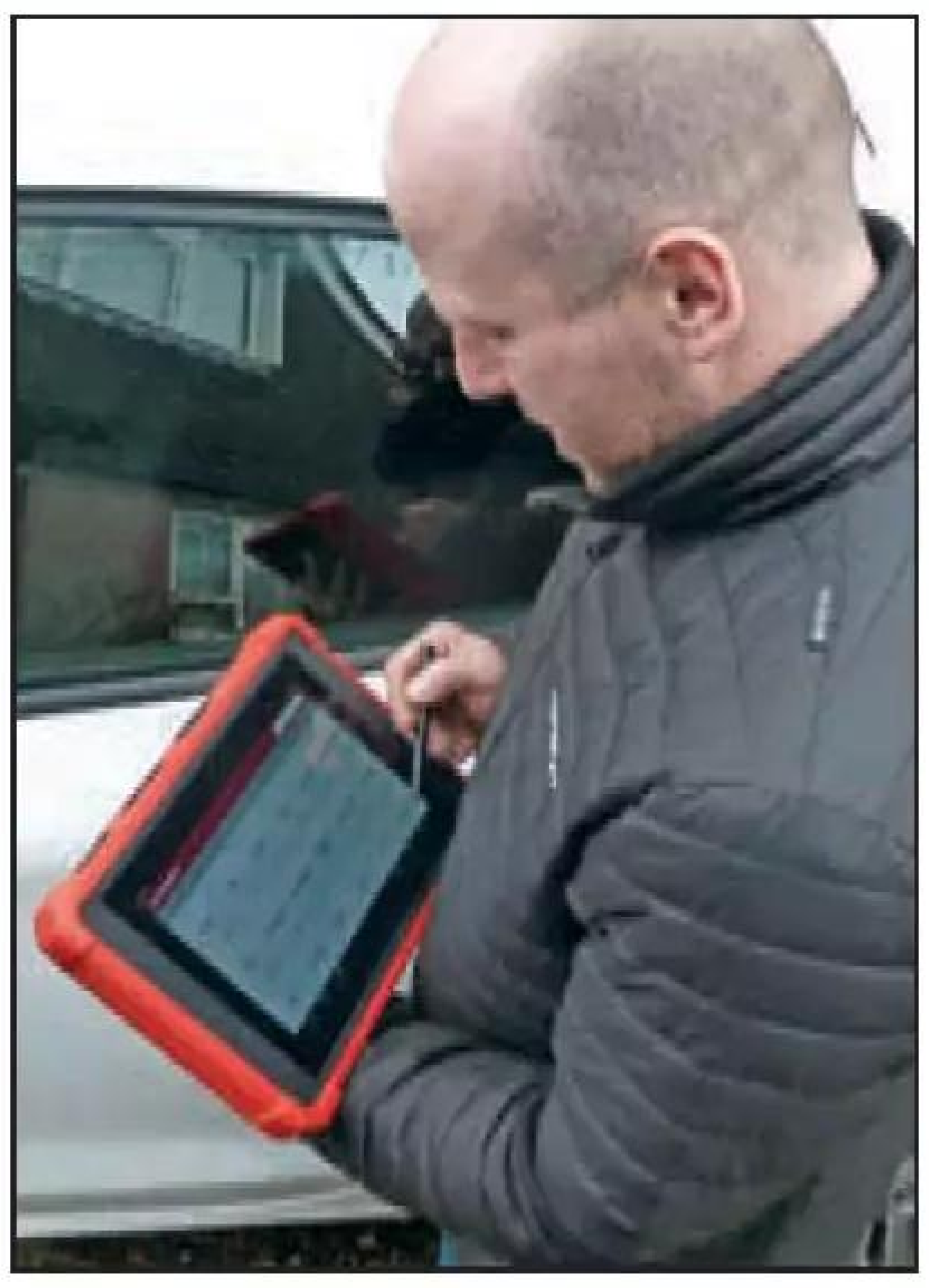
Edward says that on the last two occasions he has come across this problem, the vehicle had just been serviced, and there seems to be no obvious specific reason for the breakdowns occurring…

A diagnostic check will show a fault relating to the relevant cylinder, for example "P1259 injector 1 – open circuit". You can check live data and look at all the injectors to see any failing, but a simple test with a multimeter set

Tool of choice

▶ The Launch X431 Euro Tab II tool is extremely useful for a multitude of high level/in-depth diagnostic operations on this Peugeot. The equipment automatically identifies the actual vehicle under review and its main drivetrain components. The operator can then use the tool to show a wide variety of screen-shots, including (for example) those relating to system components/computers present around the vehicle, live data, also injector codes and performance (and so on). An invaluable feature is that the tool can easily and rapidly be used by the operator to control/operate individual systems and components remotely via Bluetooth.

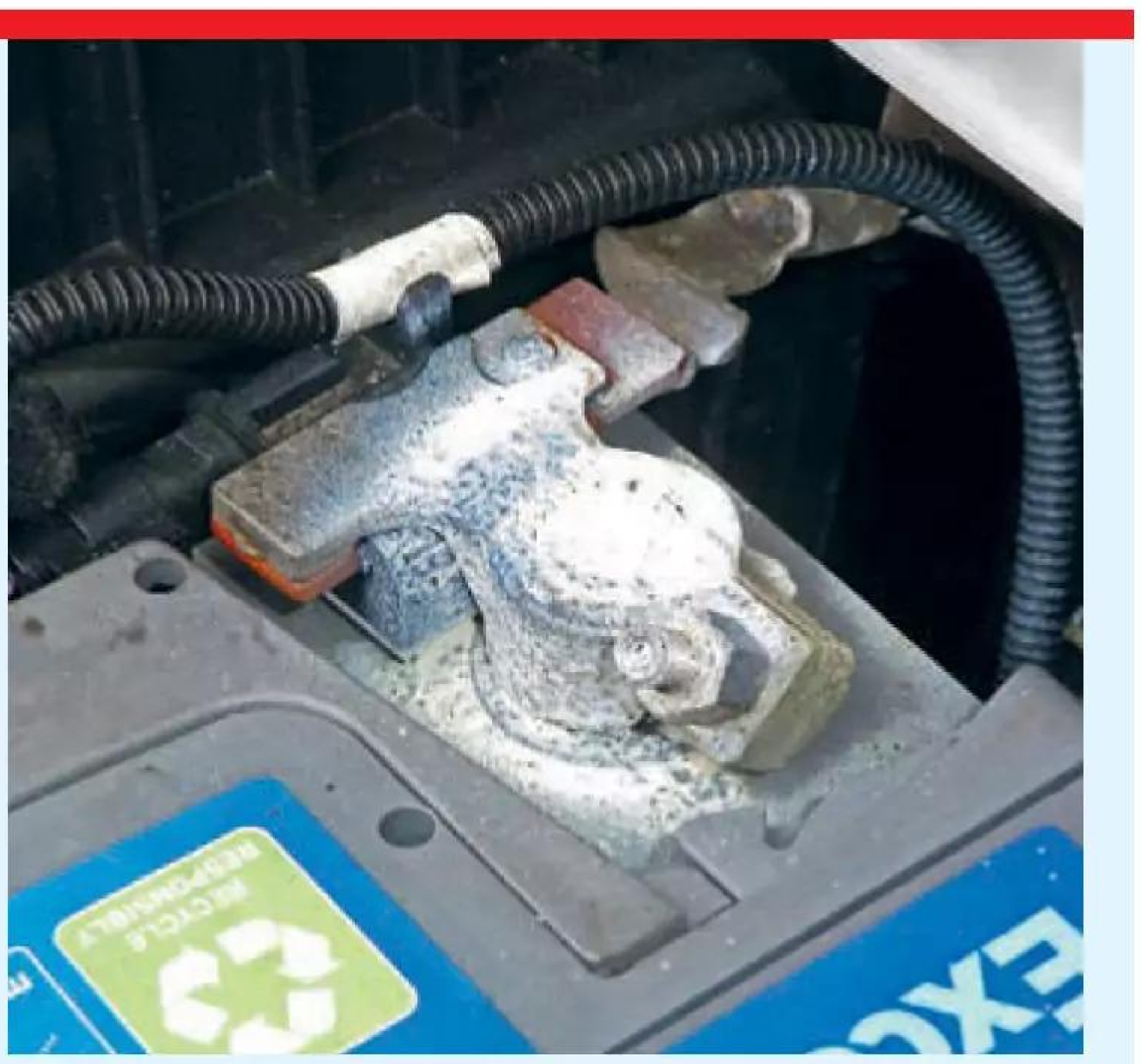
The Launch equipment can also be used for a wide variety of other makes and models too.

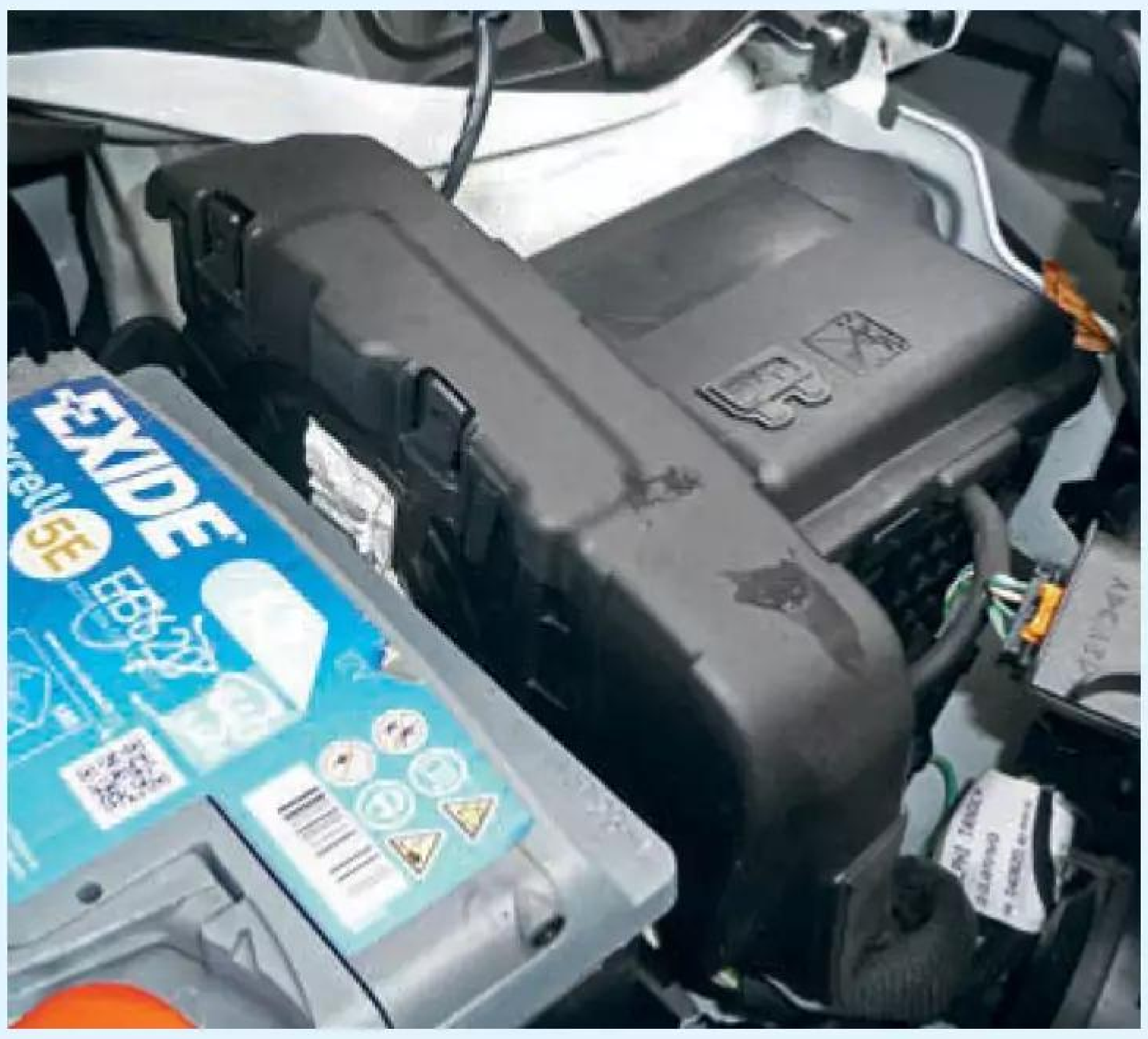


Typical Peugeot 208 components

1 ◀ The all-important 12V battery is readily accessible and relatively easy to change, whenever required. However, it's essential to ensure that only the type as recommended by Peugeot is used, to ensure correct operation with the car's smart charge and Stop-Start set-up.

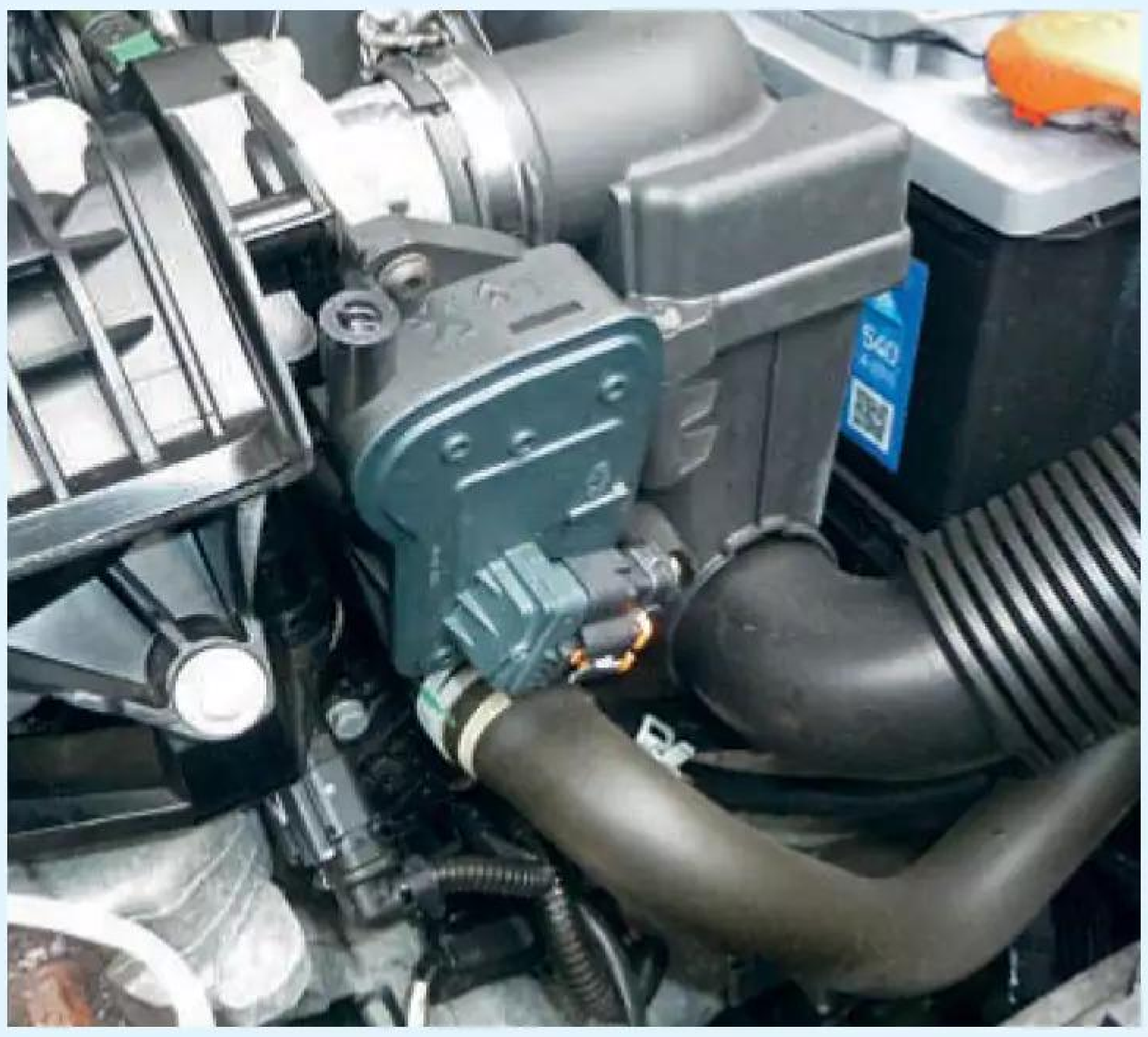
2 ▶ Reliability is helped by making sure that the battery terminals are kept clean, and coated with protectant to keep moisture and corrosion at bay. Note that this 208's negative (earth) battery terminal incorporates a battery charge monitoring system.





3 ◀ The ECU is positioned vertically within a protective case, and is sandwiched between the battery and the underbonnet fusebox. It is easy to reach and access is unhindered. Check the connections, and ensure that the unit is dry and undamaged. A coating of water dispellant spray applied to the connectors, will help to seal them and keep out moisture.

4 ▶ The drive-by-wire' system's throttle body assembly is located right at the front of the engine, towards the left-hand side. Ensure that the electrical connections are secure and clean.



5 ◀ The crankshaft position sensor is mounted low down on the engine, at the front, and deeply tucked away, making it difficult for our camera to see it. Check the unit for security and ensure that its wiring/connections are sound and clean.

6 ▶ Another component situated low down at the front of the engine is the post-catalytic converter oxygen/O2/Lambda sensor. It is not easy to see but in fact is not too difficult to reach if ever it needs to be changed. Check its condition and wiring/connections.

to 'resistance' and checking across the injector will show up faulty injector windings. For a good injector you should be seeing around 12 ohms; any other values will indicate a faulty injector.

Replacement is straightforward; simply remove the fuel rail, release/remove the injector. Note that new injectors are supplied with O-rings; just apply a smear of grease to aid installation. No coding is required.

Fault 2:

MAP SENSOR DEFECT

When this problem occurs, depending on how well the driver is 'tuned into' his or her car, initially he or she may not notice any difference in the way in which the vehicle drives, yet the engine management lamp will be illuminated and poor performance may be evident.

ENGINE MANAGEMENT

This Peugeot 208 incorporates these primary components:

- Multi-plug ECU .
- 3 x solenoid injectors.
- 3 x ignition coils.
- MAP sensor.
- Pre- and post-catalyst oxygen sensors.
- Digital cam and crank sensor.
- In-tank fuel pump .
- Coolant temperature sensor monitoring engine temperature.
- Fly-by-wire throttle body.
- Valve timing via inlet and exhaust actuators.

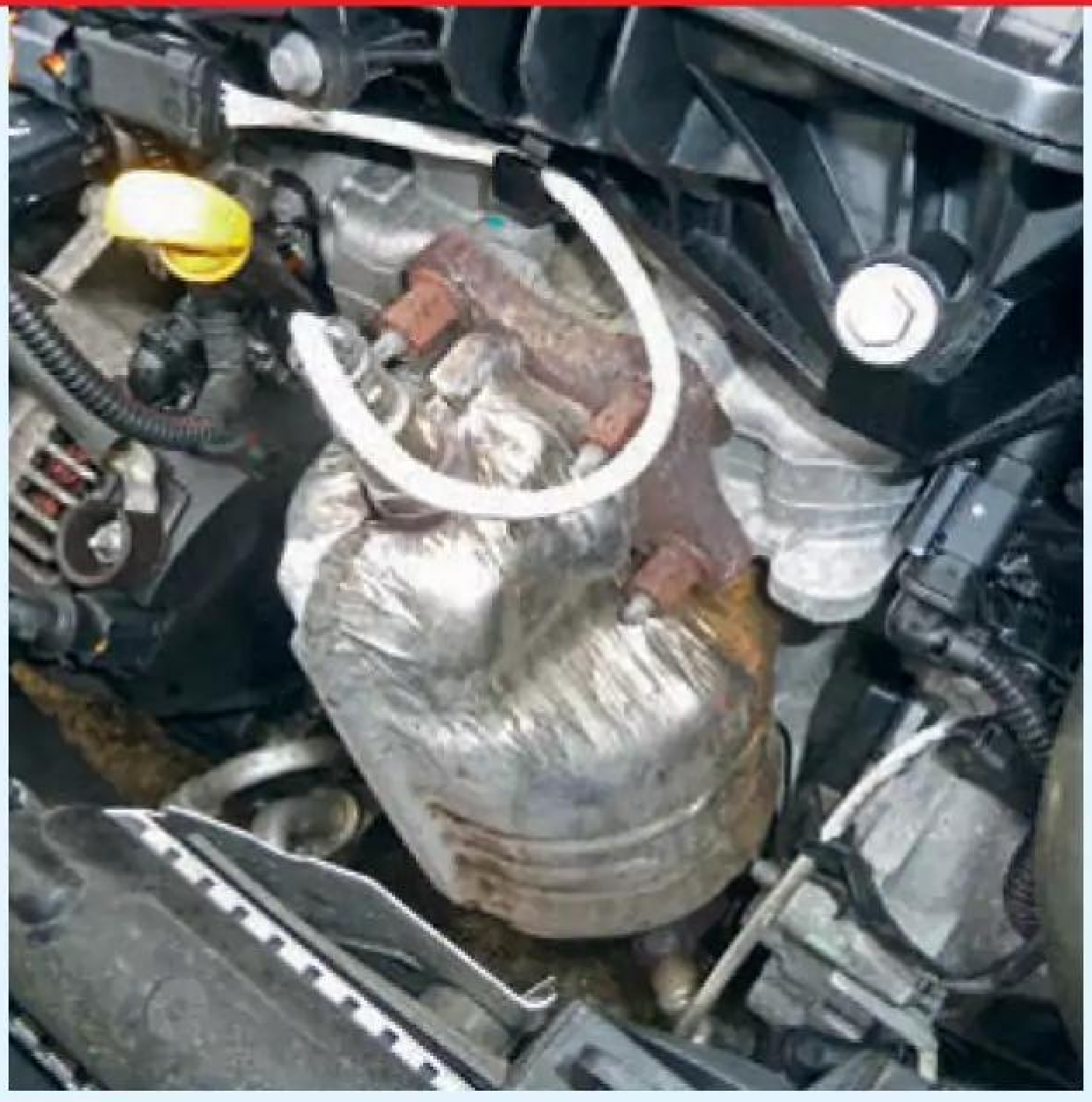
Carrying out a diagnostic check will show fault code P13a8, 'intake air pressure measurement system error'. A quick test here could be looking at live data with key on, engine off. In this situation you should be seeing 0-volts, but when the MAP sensor fails, spurious readings will occur.

Another check can be carried out with a multimeter set to 'volts', and measuring across pins 1 and 4; with the engine idling you should see 2-volts, and at 3000rpm, 1.2-volts. Again, no or slow movement here shows that the MAP sensor is failing.

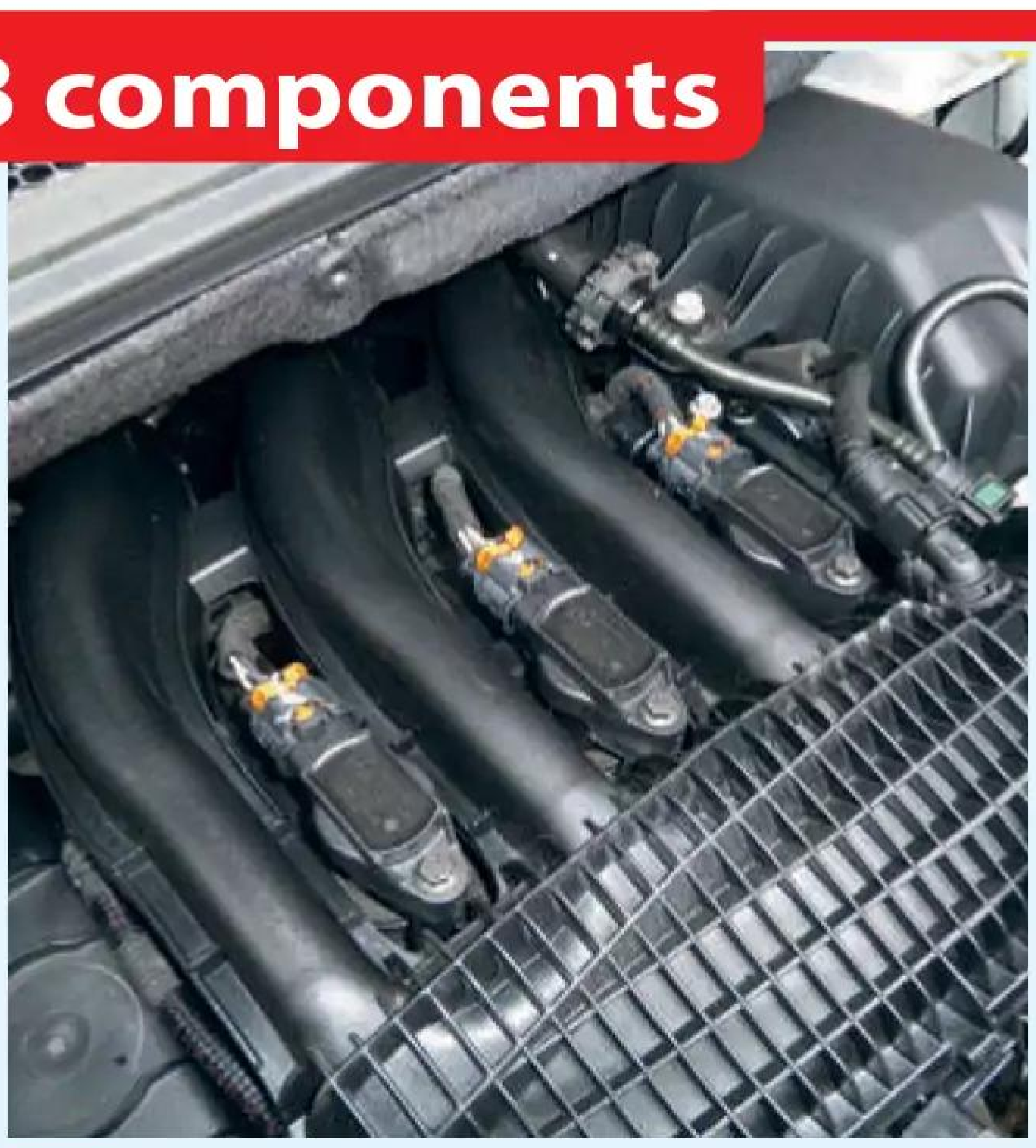
Before condemning and renewing the sensor, it is worth removing it and gently cleaning it, for it's amazing how much just a tiny speck of dirt can affect the reading.

The sensor is held in place with a single Torx 30 screw. Once the sensor

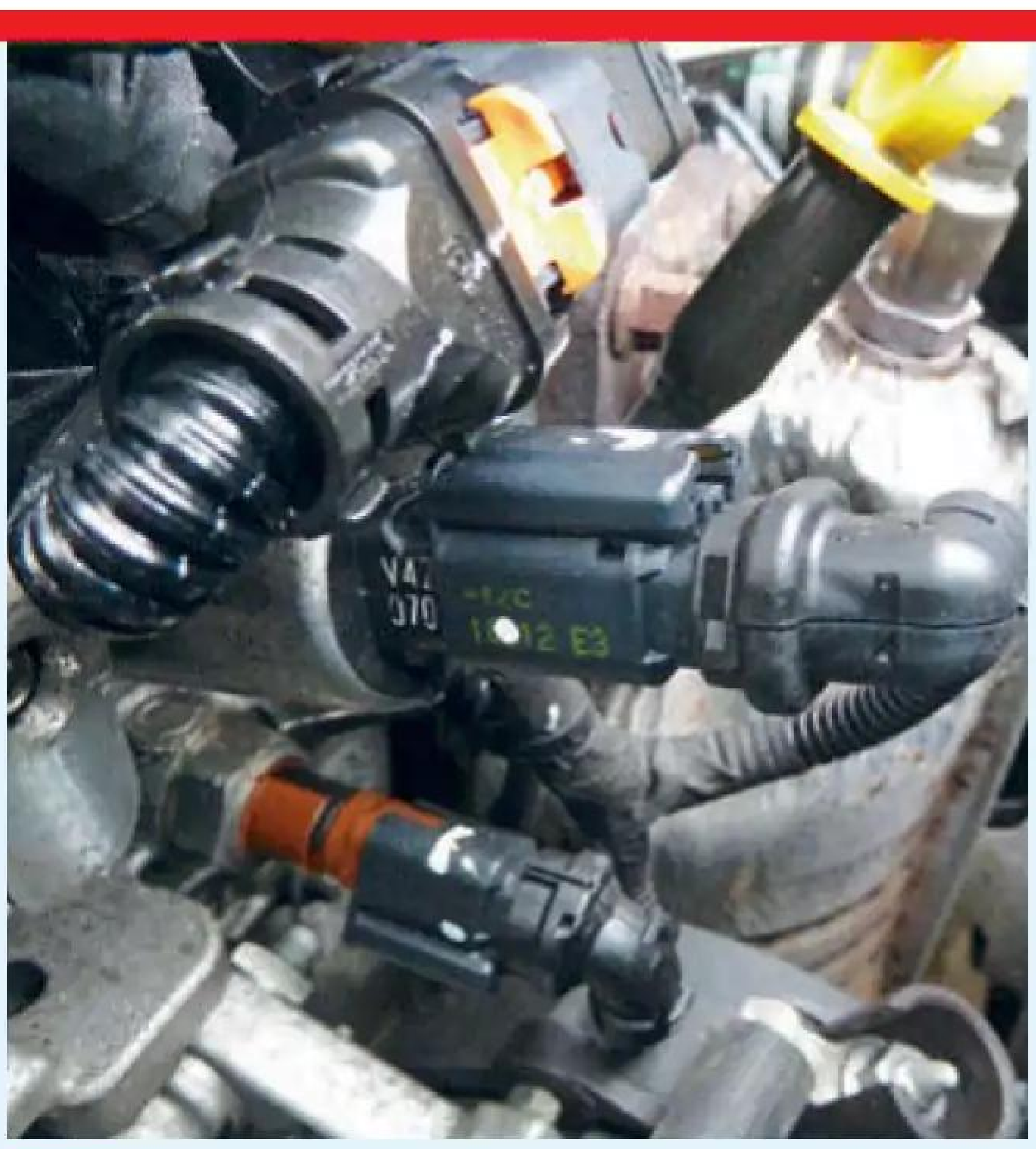
Typical Peugeot 208 components



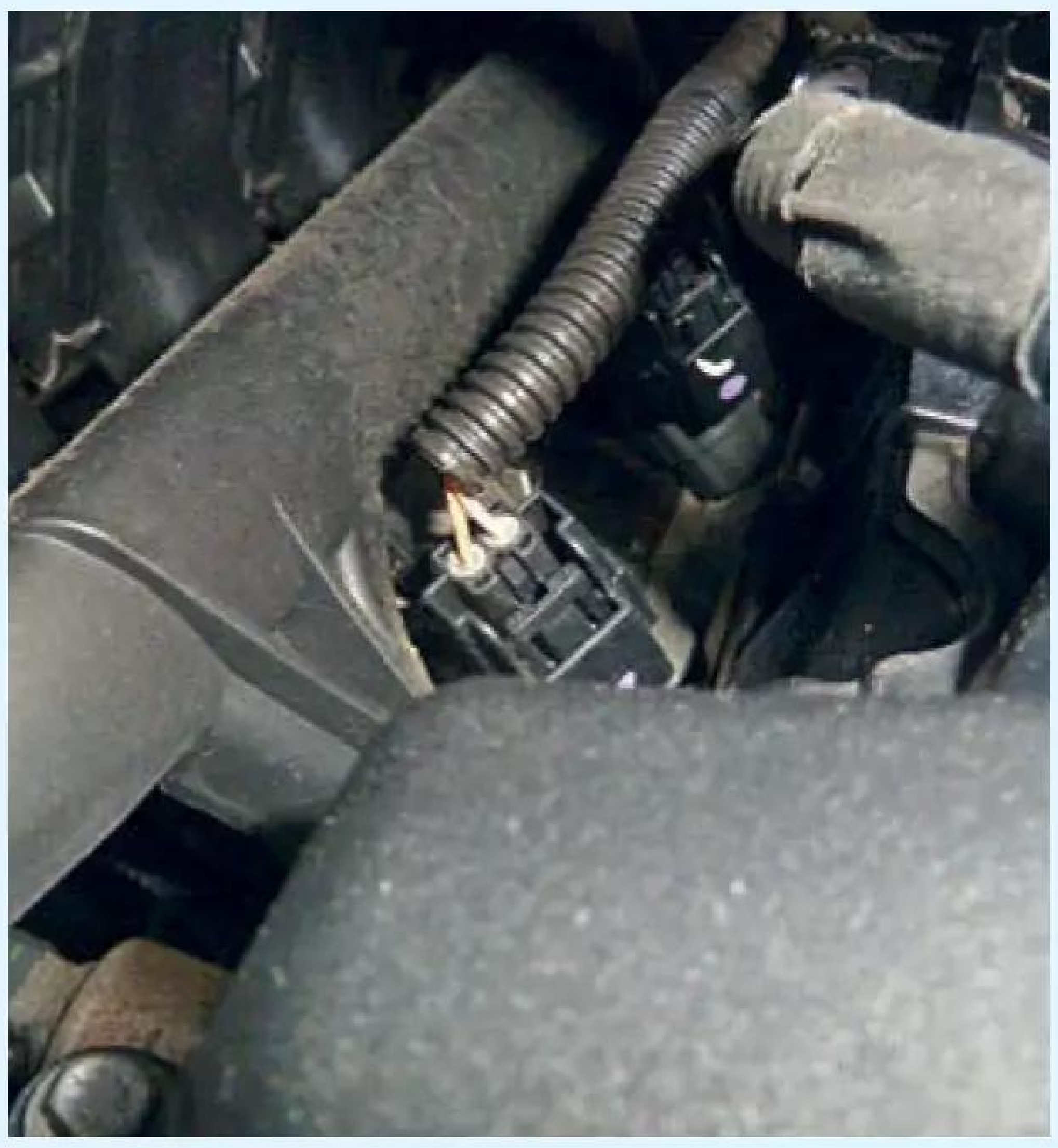
7 **The catalytic converter and the pre-cat oxygen/O2/Lambda sensor are located very accessibly right at the front of the engine, and the 'cat' is attached directly to the manifold, where it can rapidly achieve optimum temperature; it's easy to change.**



8 **Nestling in a row across the top of the engine are the three ignition coils. As with any three-cylinder motor, breakdown of one or more coils makes the car virtually undriveable. Ideally renew all three coils together; use high-quality replacements.**

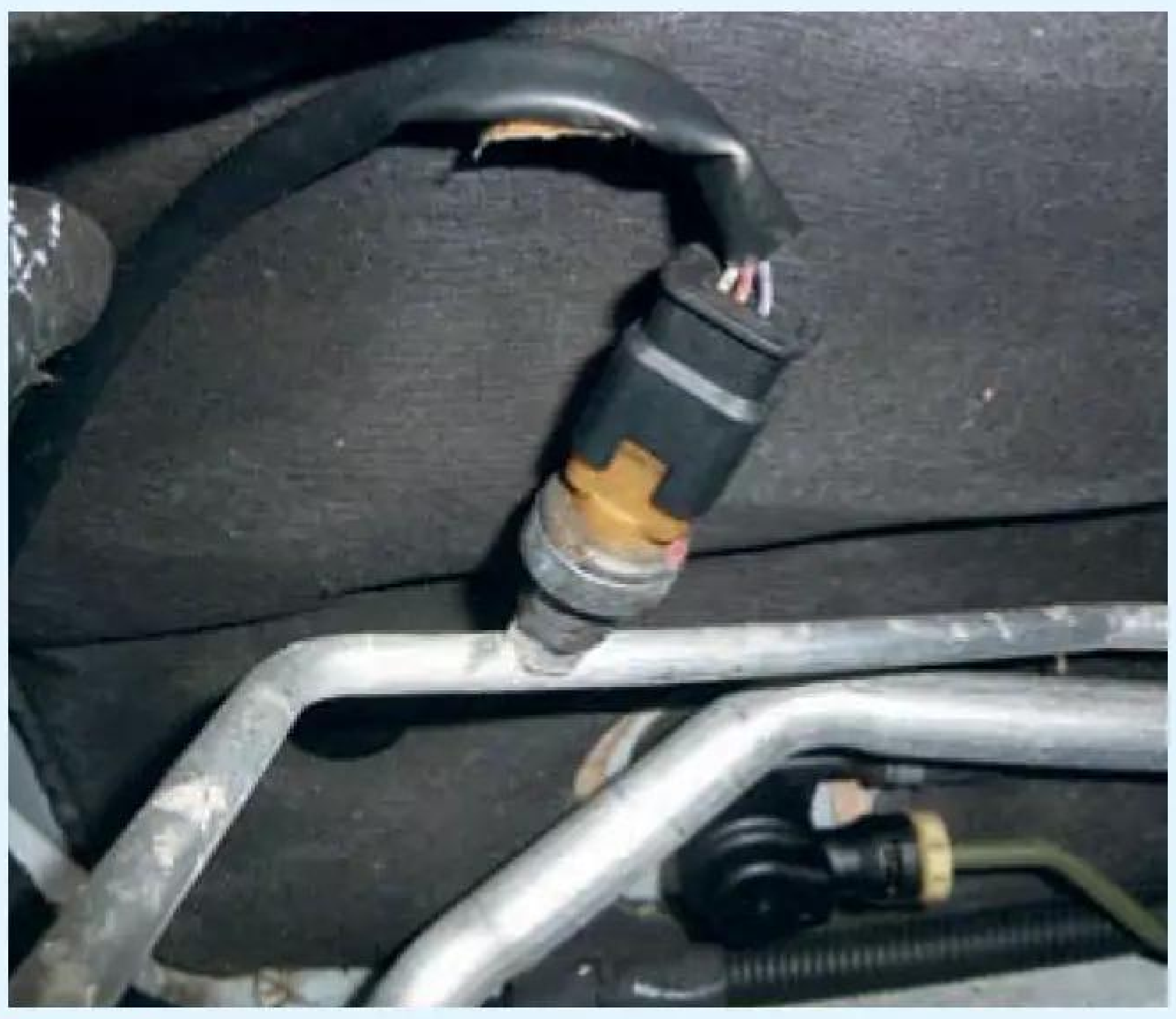


9 **Found just to the right-hand side of the dipstick is the camshaft solenoid for the variable valve timing system. It's essential for the engine oil to be clean or the solenoid assembly can block internally, creating a misfiring engine.**



10 **Visible in the centre of this photograph is one of the three fuel injectors; these are of the solenoid type.**

11 **A smart charge system activates the alternator to re-charge the battery only when required, saving power, fuel and emissions. DO NOT jump-start the car when the battery is discharged; the high voltages supplied may damage electronic components.**



12 **Located right at the back of the engine compartment, and beneath the overhanging bulkhead, is the 'three-wire' air-conditioning system pressure sensor. If the sensor detects pressure loss, for example due to leaks, it will shut down the system.**

has been removed, check the condition of the sealing O-ring, looking for splits or any other damage.

Fault 3:

DEFECTIVE EVAP CANISTER PURGE VALVE

The operator may be presented with a vehicle that has failed the emissions check part of the MOT test, although the driver may not report any power loss or driving issues.

The engine light may or may not be illuminated, but a definite is that fault code P0172 'system too rich bank 1 error' will be stored, and full diagnostic and real time checks are required to confirm the culprit.

The EVAP system prevents fuel vapours from the tank from escaping into the atmosphere, trapping the vapours and temporarily storing them in a charcoal canister.

The system incorporates a canister purge valve, which can malfunction so that the system doesn't vent properly, resulting in high emission levels.

Testing is straightforward; remove the multi-plug and, with a multimeter set to resistance, check the reading obtained for the purge valve, which should be 26 ohms.

Fault 4:

BRAKE LAMP SWITCH FAILURE

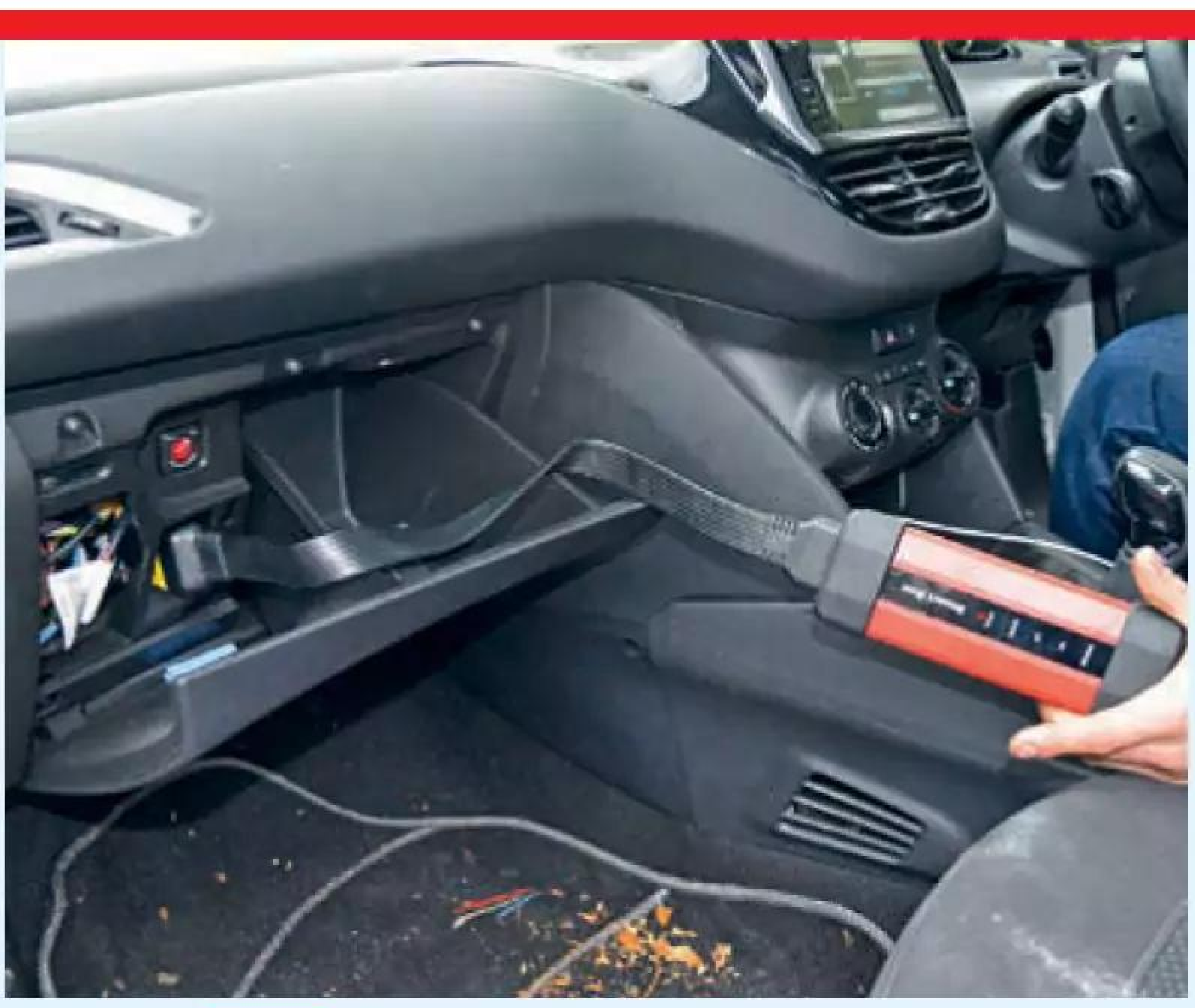
Failure of the brake lamp switch is a common occurrence on these Peugeots, resulting in random illumination of various warning lamps, as the ECUs for the systems affected fail to detect the signal from the brake lamp circuit. In addition, of course, the brake lamps will not operate, and a first check is to see whether they are working.

Renewal of the switch is not so very easy as it is mounted low down in the footwell so it is necessary to bend to reach it!

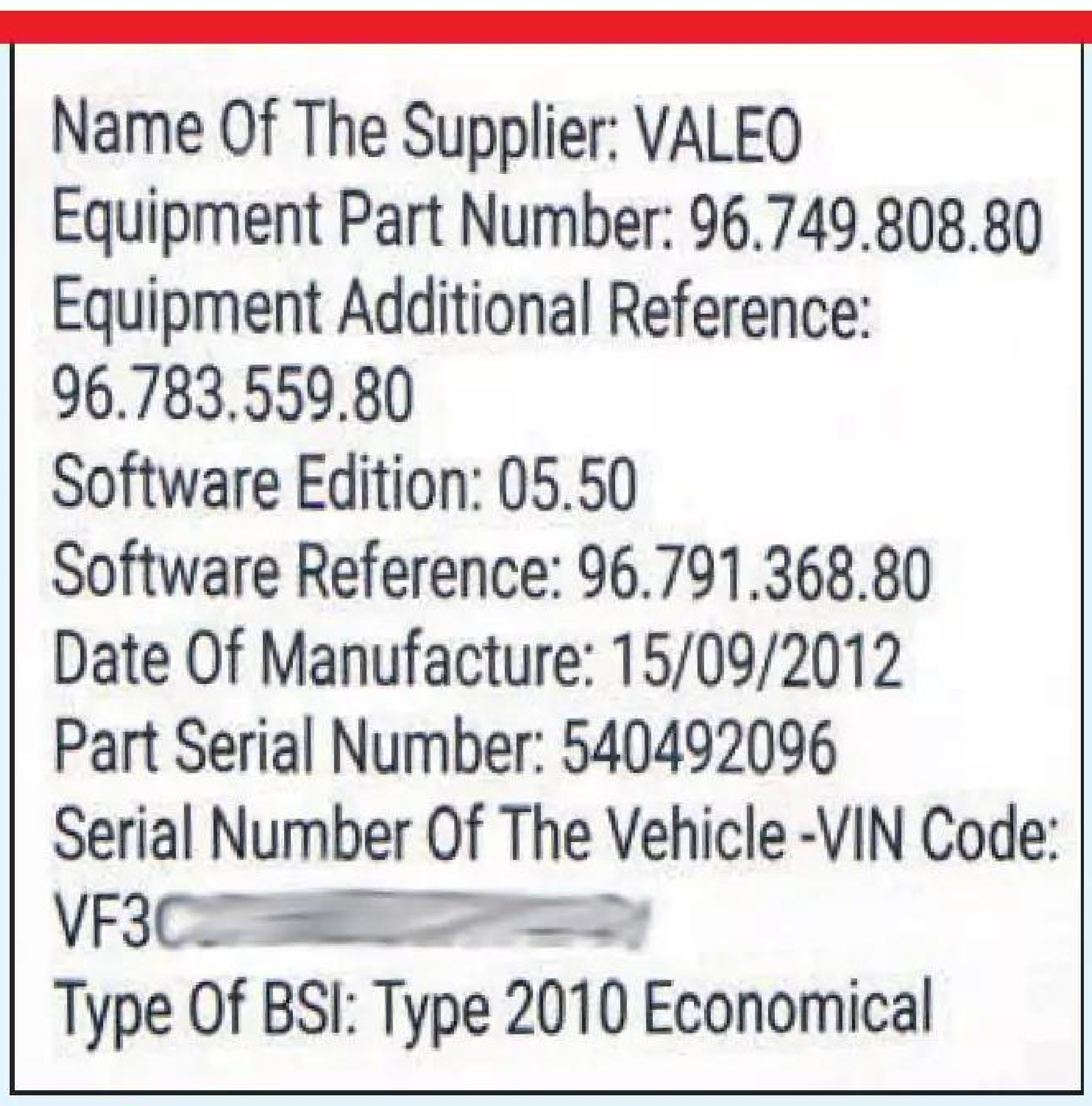
Technical Specs

Actual values

Component	Value
Injector resistance	12 ohms
Ignition coil pins 1 & 3	2.8 ohms
Oxygen sensor heater circuit	5 ohms
Cam and crank sensors	5-volt supply
Fuel pressure	3.3-3.6 bar
EVAP valve	26 ohms

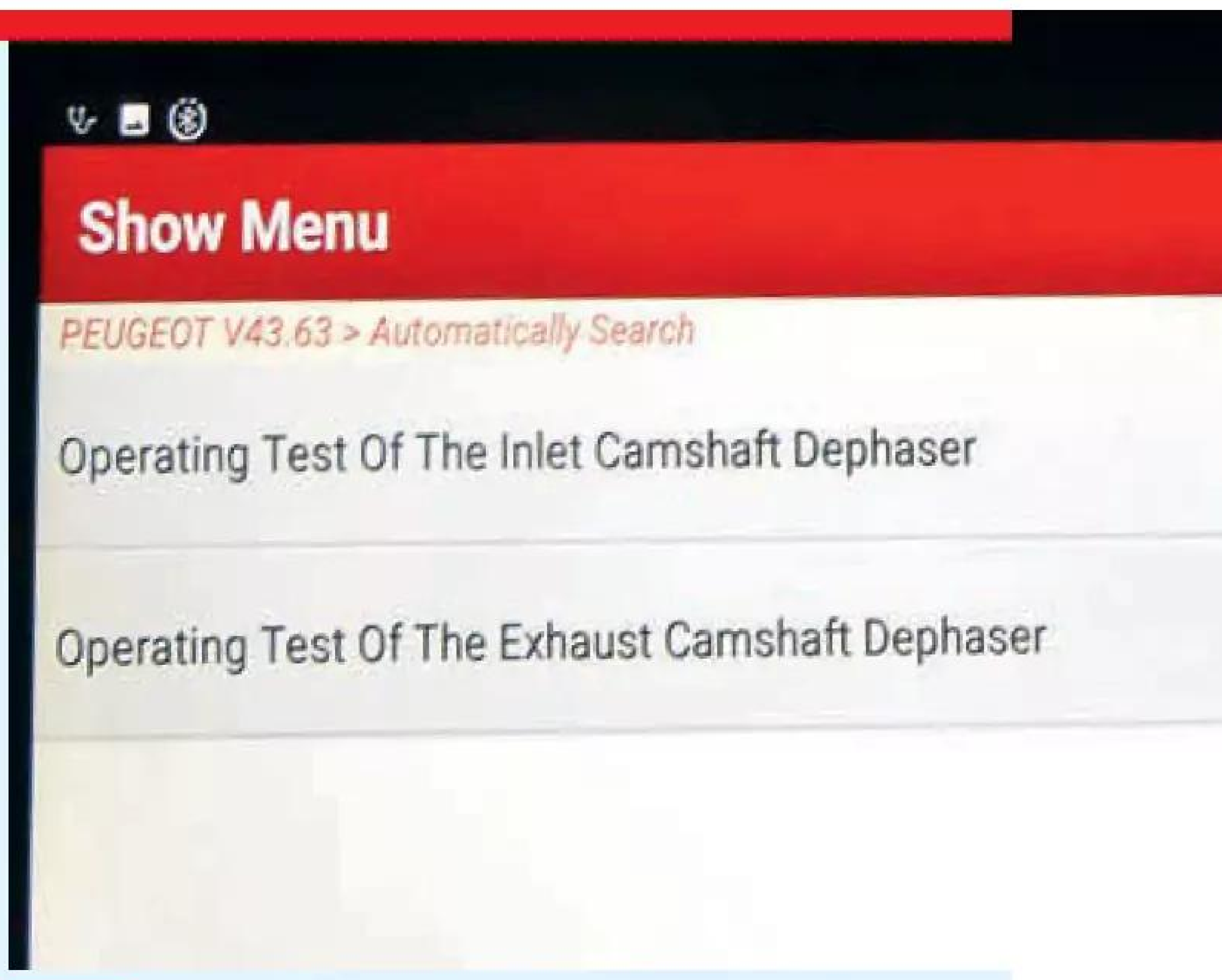


13 This 208's diagnostic socket is located within the glovebox, on the passenger side of the car. In this shot, Edward has just connected the Launch diagnostic tool, with information then being transmitted to the machine's screen via Bluetooth.

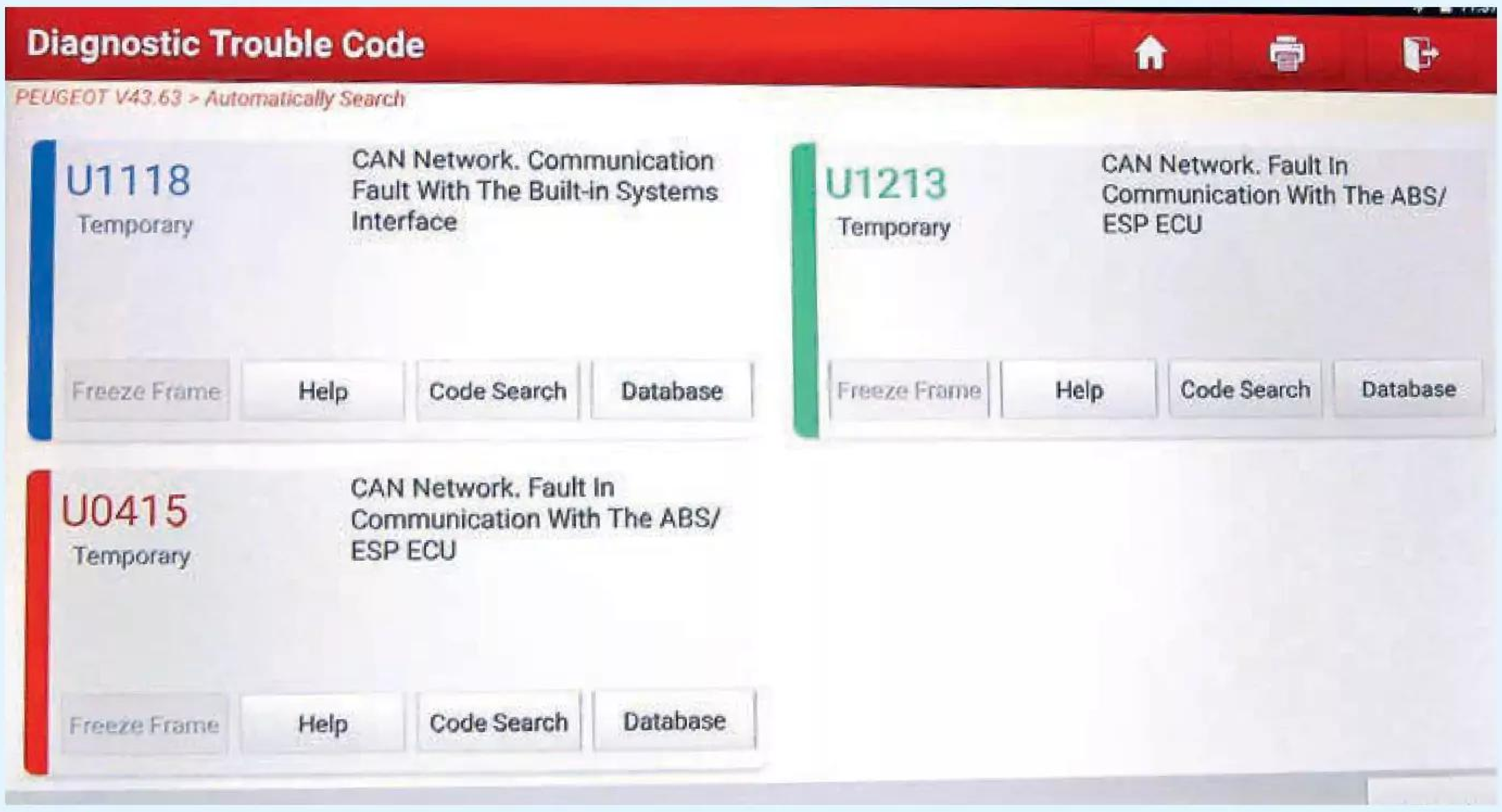


Name Of The Supplier: VALEO
Equipment Part Number: 96.749.808.80
Equipment Additional Reference: 96.783.559.80
Software Edition: 05.50
Software Reference: 96.791.368.80
Date Of Manufacture: 15/09/2012
Part Serial Number: 540492096
Serial Number Of The Vehicle -VIN Code: VF3[redacted]
Type Of BSI: Type 2010 Economical

14 This informative and invaluable screen shot on the Launch tool works via a built-in system interface to impart information on the 208's Body Control Module. At a glance the operator can identify the module type and number, plus software information.


Show Menu
PEUGEOT V43.63 > Automatically Search
Operating Test Of The Inlet Camshaft Dephaser
Operating Test Of The Exhaust Camshaft Dephaser

15 Special functions available to the operator when using the Launch X431 Euro Tab II include the facility to remotely operate/adjust systems via the tool. In this case the inlet and exhaust camshaft timing solenoids are under scrutiny and can be controlled in this way.



Diagnostic Trouble Code

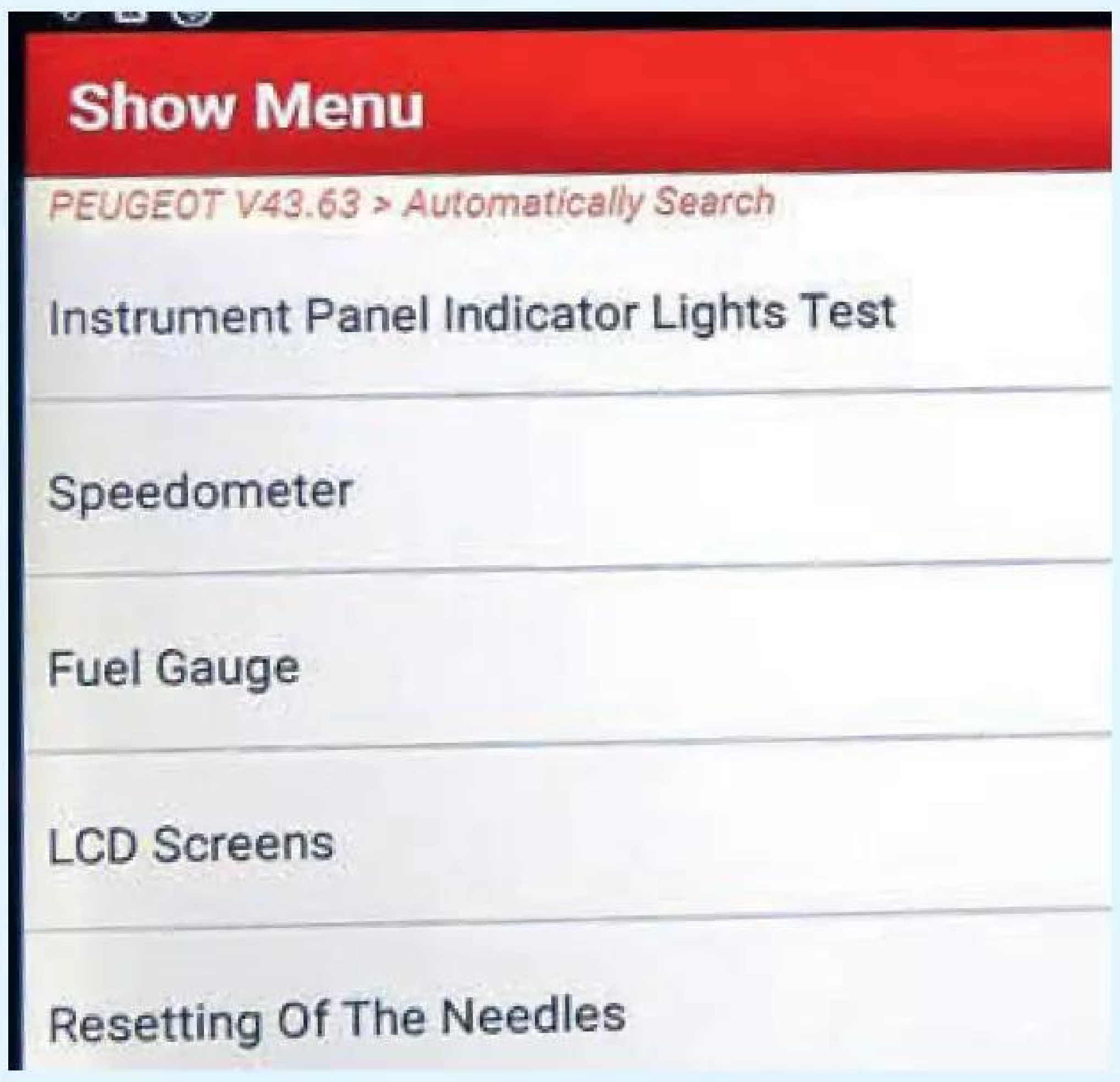
PEUGEOT V43.63 > Automatically Search

U1118 Temporary — CAN Network. Communication Fault With The Built-in Systems Interface

U1213 Temporary — CAN Network. Fault In Communication With The ABS/ ESP ECU

U0415 Temporary — CAN Network. Fault In Communication With The ABS/ ESP ECU

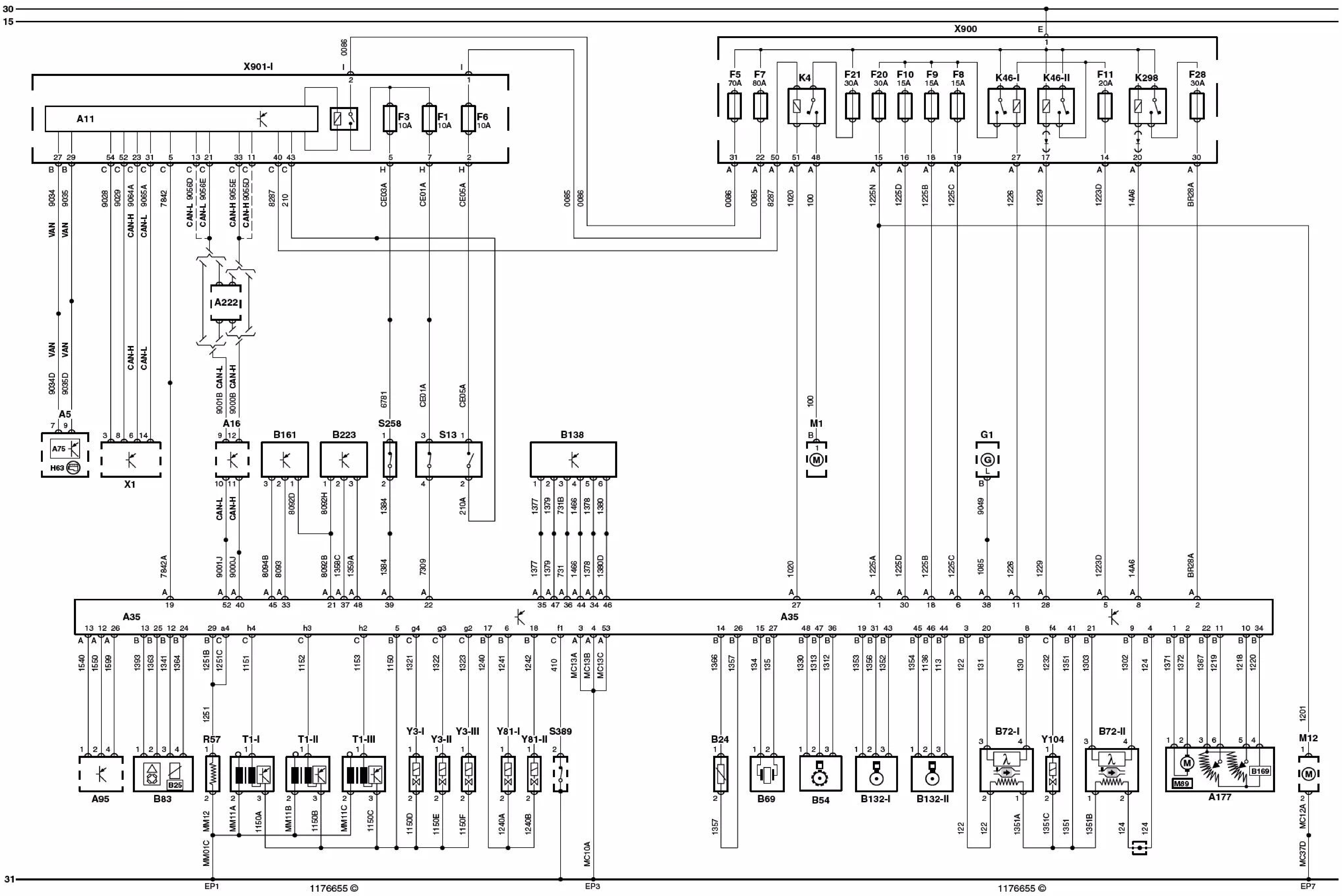
16 Stored fault codes within the engine management system's ECU can be displayed on the launch tool's screen, to help the operator. In this shot Edward is surveying a number of 'temporary' fault codes, which can be cleared by the operator via the tool.


Show Menu
PEUGEOT V43.63 > Automatically Search
Instrument Panel Indicator Lights Test
Speedometer
Fuel Gauge
LCD Screens
Resetting Of The Needles

17 From within this single screen relating to the car's instrument cluster, test-operation of the Peugeot's various instruments, panel lamps and display screens can be carried out. This enables rapid and comprehensive checking to be carried out by the operator.

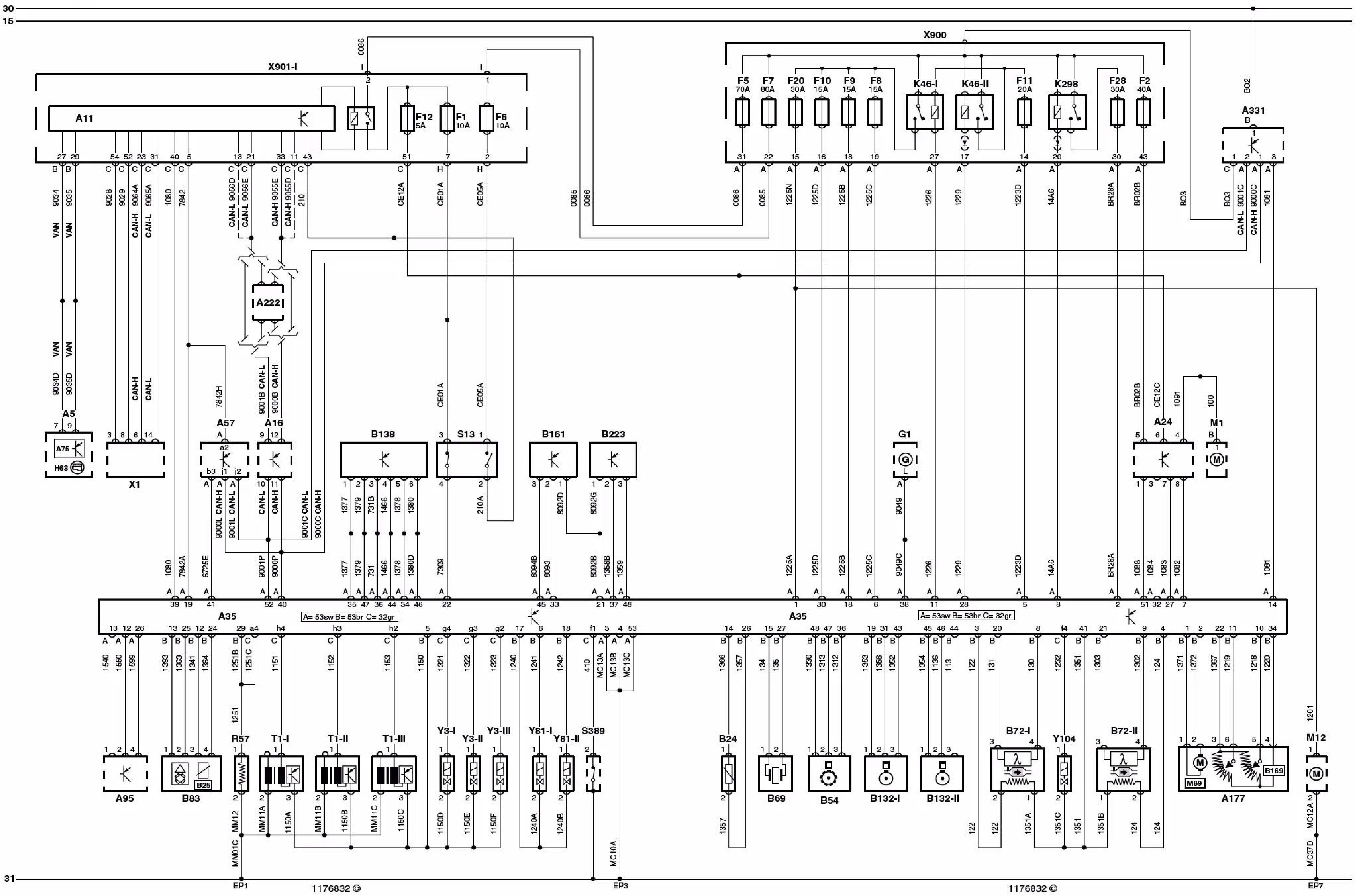
PEUGEOT 208 CIRCUIT DIAGRAMS

WITHOUT **STOP-START** SYSTEM


30
15
31
X900
X901-I
A11
F3 10A
F1 10A
F6 10A
F5 70A
F7 80A
K4
F21 30A
F20 30A
F10 15A
F9 15A
F8 15A
K46-I
K46-II
F11 20A
K298
F28 30A
VAN
CAN-H
CAN-L
A222
A5
A75
H63
X1
A16
B161
B223
S258
S13
B138
M1
G1
A35
A95
B83
B25
R57
T1-I
T1-II
T1-III
Y3-I
Y3-II
Y3-III
Y81-I
Y81-II
S389
B24
B69
B54
B132-I
B132-II
B72-I
Y104
B72-II
A177
M89
B169
M12
EP1
EP3
EP7
1176655 ©

CODE	COMPONENT DESCRIPTION
A5	Instrument panel
A11	Multifunction control module
A16	ABS control module
A35	Engine control module (ECM)
A75	Instrumentation control module
A95	Engine coolant blower motor control module
A177	Throttle control unit
A222	Parking aid control module
B24	Engine coolant temperature (ECT) sensor
B25	Intake air temperature (IAT) sensor
B54	Crankshaft position (CKP) sensor
B69	Knock sensor (KS)
B72-I	Heated oxygen sensor (HO2S) | **1**
B72-II	Heated oxygen sensor (HO2S) | **2**
B83	Manifold absolute pressure (MAP) sensor
B132-I	Camshaft position (CMP) sensor | **1**
B132-II	Camshaft position (CMP) sensor | **2**
B138	Accelerator pedal position (APP) sensor
B161	AC refrigerant pressure sensor
B169	Throttle motor position sensor
B223	Brake system vacuum sensor
CAN-L	Controller area network (data bus) low
CAN-H	Controller area network (data bus) high
EP	Earth point
F	Fuse
G1	Alternator
H63	Engine malfunction indicator lamp (MIL)
K4	Starter motor relay
K46-I	Engine control (EC) relay | **1**
K46-II	Engine control (EC) relay | **2**
K298	Variable valve lift control module relay
M1	Starter motor
M12	Fuel pump (FP)
M89	Throttle motor
R57	Crankcase breather heater
S13	Brake pedal position (BPP) switch
S258	Clutch pedal position (CPP) switch
S389	Engine oil pressure switch
T1-I	Ignition coil | **1**
T1-II	Ignition coil | **2**
T1-III	Ignition coil | **3**
VAN	Vehicle area network (data bus)
X1	Data link connector (DLC)
X900	Fuse box/relay plate, engine bay
X901-I	Fuse box/relay plate, fascia **1**
Y3-I	Injector | **1**
Y3-II	Injector | **2**
Y3-III	Injector | **3**
Y81-I	Camshaft position (CMP) actuator | **1**
Y81-II	Camshaft position (CMP) actuator | **2**
Y104	Evaporative emission (EVAP) canister purge valve
15	Ignition switch - ignition ON
30	Battery +
31	Battery -

WITH STOP-START SYSTEM


30
15
31
X901-I
A11
F12 5A
F1 10A
F6 10A
X900
F5 70A
F7 80A
F20 30A
F10 15A
F9 15A
F8 15A
K46-I
K46-II
F11 20A
K298
F28 30A
F2 40A
A331
A222
A5
A75
H63
X1
A57
A16
B138
S13
B161
B223
G1
A24
M1
A35
A= 53sw B= 53br C= 32gr
A95
B83
B25
R57
T1-I
T1-II
T1-III
Y3-I
Y3-II
Y3-III
Y81-I
Y81-II
S389
B24
B69
B54
B132-I
B132-II
B72-I
Y104
B72-II
A177
M89
B169
M12
VAN
CAN-H
CAN-L
EP1
EP3
EP7
1176832 ©

CODE	COMPONENT DESCRIPTION
A5	Instrument panel
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A24	Stop-start system control module
A35	Engine control module (ECM)
A57	Transmission control module (TCM)
A75	Instrumentation control module
A95	Engine coolant blower motor control module
A177	Throttle control unit
A222	Parking aid control module
A331	Voltage stabiliser module
B24	Engine coolant temperature (ECT) sensor
B25	Intake air temperature (IAT) sensor
B54	Crankshaft position (CKP) sensor
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Y81-II	Camshaft position (CMP) actuator | **2**
Y104	Evaporative emission (EVAP) canister purge valve
15	Ignition switch - ignition ON
30	Battery +
31	Battery -

PREPARATION DATA

Below are the official change intervals for the various components. Edward advises these service/change intervals are at least halved.

Service intervals Officially every 12,500 miles or 12 months, whichever comes first.

Spark plugs & air filter Officially every 37,500 miles or 48 months, whichever comes first.

Cambelt Wet belt system. Renew at least every 62,000 miles or 60 months.

Engine oil Every 12,500 miles or 12 months, whichever comes first.

Oil type SAE 5W-30 fully-synthetic.

Capacity (service fill) 3.3 litres.

Oil filter torque setting 15Nm.

Sump plug torque setting 42Nm.

Brake fluid Every 24 months.

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OIL SERVICE STATION

1.9M MAX. HEIGHT

70L STORAGE TANK

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Complete with three storage drawers and a **61-piece** set of oil filter cup wrenches and drain keys.

The station features a **70L** storage tank with a sight glass, a 10L catch pan, and a 10L measuring cup for vacuum extraction.

Supplied with oil suction tubes in various sizes: 1 x 5mm Ø, 2 x 6mm Ø, and 2 x 8mm Ø, each 700mm long.

Powered by workshop air, it supports vacuum extraction and emptying with an air supply of up to 110psi (8bar).

The durable steel trolley measures 790(w) x 420(d) x 890mm(h) and has four 4" wheels – two fixed and two swivel with brakes – for easy mobility.

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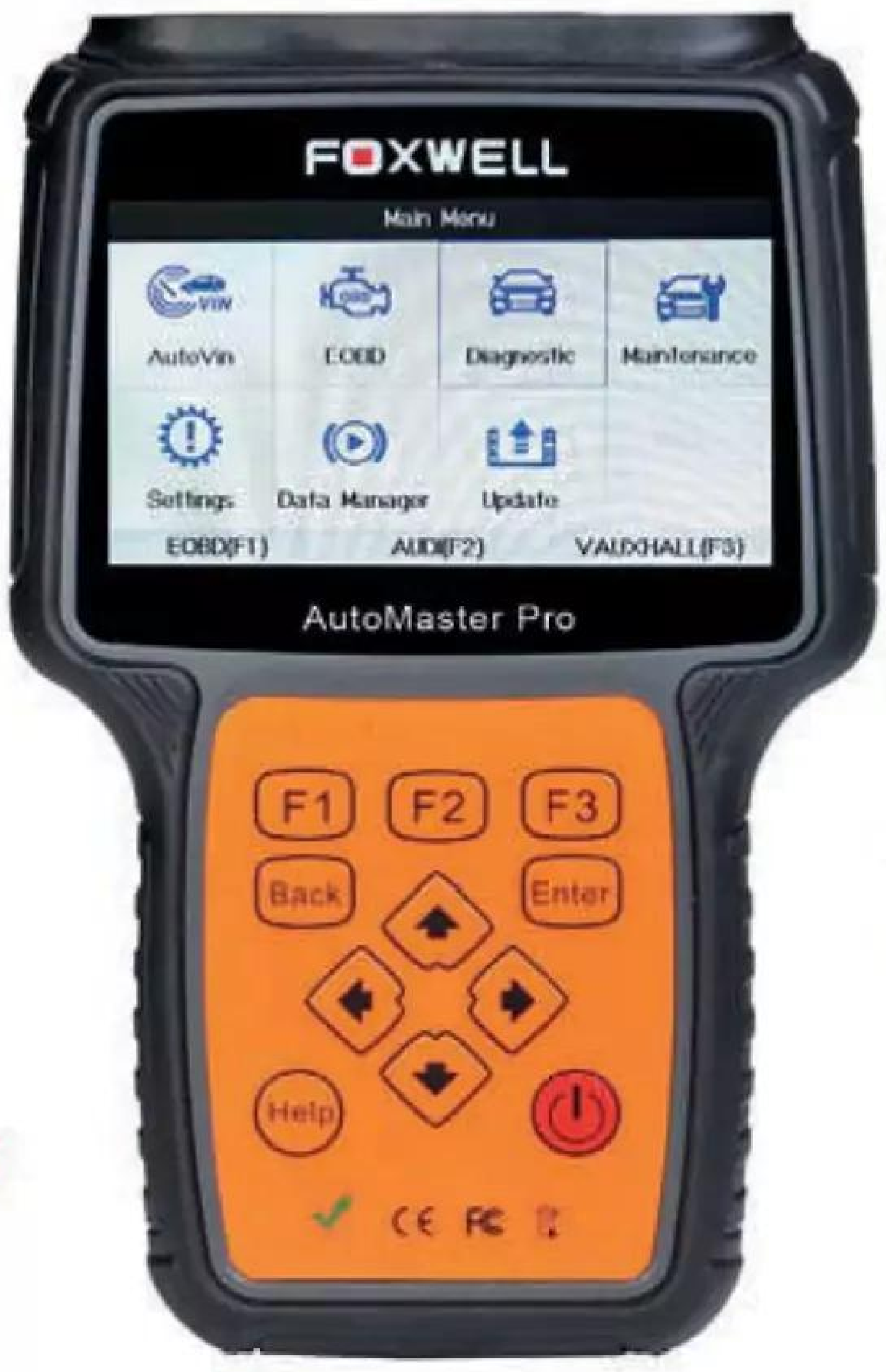

Multi-car 4-Systems Scan Tool

Foxwell NT680 Lite

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